DEPARTMENT OF THE NAVY
BASE REALIGNMENT AND CLOSURE
PROGRAM MANAGEMENT OFFICE WEST
1455 FRAZEE RD, SUITE 900
SAN DIEGO, CA 92108-4310

Ser BPMOW.cny/0676
JUL 3 0 2010

Mr. Mark Ripperda (SFD 8-1)
U.S. Environmental Protection Agency, Region IX
75 Hawthorne Street
San Francisco, CA 94105-3901

Mr. Larry Morgan
California Department of Public Health
1616 Capitol Avenue, MS 7402
P.O. Box 997377
Sacramento, CA 95899-7377

Dear Regulatory Team Members:

Enclosed please find revised pages which constitute the Final Base-wide Storm Drain and Sanitary Sewer Removal Work Plan, Revision 4, Hunters Point Shipyard, San Francisco, California. This Work Plan has been revised to update the previous version of the Sampling and Analysis Plan to the Uniform Federal Policy for Quality Assurance Project Plans format of 37 worksheets. The revision also includes updates to any laboratory information that may have changed since Revision 3. Changes are therefore limited to Appendix A, the Sampling and Analysis Plan.

The enclosed pages include a new cover, spine, interior signature page, and a complete replacement of Appendix A. The CD provided with the enclosure contains the complete Work Plan, including the revised Appendix A, in electronic format.

If you have questions about the enclosed documents, please contact Mr. Chris Yantos at (619) 532-0912, or Mr. Keith Forman at (619) 532-0913.

Sincerely,

for

KEITH FORMAN
BRAC Environmental Coordinator
By direction of the Director

Enclosure: 1. Final Base-wide Storm Drain and Sanitary Sewer Removal Work Plan, Revision 4, Hunters Point Shipyard, San Francisco, California, July 2010.

Copy to:

Diane Silva (2 Hard Copies, 1 unbound, CD)
NAVFAC Southwest (Code EV33)
Naval Base San Diego
2965 Mole Rd., Bldg. 3519
San Diego, CA 92136

Karla Brasaemle (Hard Copy and CD)
90 New Montgomery St., Suite 710
San Francisco, CA 94105

Laurie Lowman (3 Hard Copies and 3 CDs)
Building 1971
NWS P.O. Drawer 260
Yorktown, VA. 23691-0260

Ryan Miya (Hard Copy and CD)
Department of Toxic Substance Control
700 Heinz Avenue, Bldg. F, Suite 200
Berkeley, CA 94710

Amy Brownell (CD Only)
SF Department of Public Health
1390 Market St., Suite 210
San Francisco, Ca 94102

Michael Sharpless (CD Only)
Paul Hastings, et al.
55 2nd Street, 24th Floor
San Francisco, CA 94104-2635

Elaine Warren (CD only)
Office of the City Attorney
City Hall, Room 234
1 Dr. Carlton B. Goodlett Place
San Francisco, CA 94102-4682

Tamara Davidson (CD Only)
SF Health Department
101 Grove Street, Rm 217
San Francisco, CA 94102

Leslie Lundgren (Hard Copy and CD)
33 New Montgomery Street, Suite 2000
San Francisco, CA 94105

Leon Muhammad (Hard Copy and CD)
5048 3rd Street
San Francisco, CA 94124

Dorinda Shipman (Hard Copy and CD)
Treadwell and Rollo
555 Montgomery St., Suite 1300
San Francisco, CA 94111

Sheila Kim (Hard Copy and CD)
Mactec Engineering and Consulting, Inc.
5341 Old Redwood Highway, Suite 300
Petaluma, CA 94954

Stephen Proud (CD Only)
Lennar/BVHP
1 California St., Suite 2700
San Francisco, CA 94111

Michael McGowan (CD only)
4634 3rd Street
San Francisco, CA 94124

Stan DeSouza (CD Only)
1680 Mission St., First Floor
San Francisco, CA 94103-2414

Alex Lantsberg (CD Only)
991 Innes Avenue
San Francisco, CA 94124

Kristine Enea (CD Only)
951 Innes Avenue
San Francisco, CA 94124

Randy Brandt (CD Only)
475 14th Street, Suite 400
Oakland, CA 94612

Sarah Kloss (CD Only)
75 Hawthorne Street
San Francisco, CA 94105

Anna E. Walden Library (Hard Copy and CD)
5075 Third Street
San Francisco, CA 94124

Matt Hagemann (CD Only)
2503 Eastbluff Drive, Suite 206
Newport Beach, CA 92660

Jed Silver (CD Only)
400 Montclair Avenue #1
Oakland, CA 94606

Janice Torbet (Hard Copy and CD)
100 Larkin Street
Gov. Information Ctr., 5th Floor
San Francisco, CA 94102

Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

CONTRACT NO. N62473-07-D-3211
CTO NO. 0018

FINAL

PROJECT WORK PLAN

Revision 4
July 30, 2010

DCN: FWSD-RAC-06-0675.R4

BASE-WIDE STORM DRAIN AND
SANITARY SEWER REMOVAL
HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA

FINAL

PROJECT WORK PLAN

Revision 4
July 30, 2010

BASE-WIDE STORM DRAIN AND SANITARY SEWER REMOVAL HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA

DCN: FWSD-RAC-06-0675.R4

Prepared for:

Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

CONTRACT NO. N62473-07-D-3211
CTO NO. 0018

Prepared by:

TETRA TECH EC, INC.
1230 Columbia Street, Suite 750
San Diego, California 92101-8536

FINAL
PROJECT WORK PLAN
REVISION 4

BASE-WIDE STORM DRAIN AND SANITARY SEWER REMOVAL HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA

DCN: FWSD-RAC-06-0675.R4

APPROVAL FORM

Bill Dougherty

Bill Dougherty TtEC Project Manager	7/28/2010 Date

Erik J. Abkemeier

Erik Abkemeier TtEC Radiation Safety Officer	7/28/2010 Date

Laurie Lowman

Laurie Lowman Radiological Affairs Support Office	7/28/2010 Date

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ABBREVIATIONS AND ACRONYMS

α	alpha
β	beta
γ	gamma
μR/hr	microRoentgen per hour
AEC	Atomic Energy Commission
AHA	Activity Hazard Analysis
ALARA	as low as reasonably achievable
AM	Action Memorandum
ARAR	applicable or relevant and appropriate requirement
BAAQMD	Bay Area Air Quality Management District
bgs	below ground surface
BMP	Best Management Practice
BRAC	Base Alignment and Closure
Cal/EPA	California Environmental Protection Agency
Cal-OSHA	California Occupational Safety and health Administration
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHMM	Certified Hazardous Materials Manager
CHP	Certified Health Physicist
CIH	Certified Industrial Hygienist
CIP	cast iron pipe
cm	centimeters
cm^2	square centimeters
CMP	corrugated metal pipe
cpm	counts per minute
^{137}Cs	cesium-137
CSO	Caretaker Site Office
CSP	Certified Safety Professional
CTO	Contract Task Order
DAC	derived airborne concentration

ABBREVIATIONS AND ACRONYMS

(Continued)

DCGL	derived concentration guideline level
DET	Detachment
DHS	Department of Health Services
DNAPL	dense non-aqueous phase liquid
DoD	Department of Defense
DON	Department of the Navy
DOT	Department of Transportation
dpm	disintegrations per minute
DQO	data quality objective
DTSC	Department of Toxic Substances Control
EP	extraneous pipe
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
ES	excavated soil
ESS	Environmental and Safety Specialist
FSS	Final Status Survey
g/cm^3	grams per cubic centimeter
GPR	ground-penetrating radar
GPS	Global Positioning System
G-RAM	general radioactive materials
HDPE	high-density polyethylene
HLA	Harding Lawson Associates
HPS	Hunters Point Shipyard
HRA	Historical Radiological Assessment
IR	Installation Restoration
IRP	Installation Restoration Program
ISO	International Organization for Standardization
keV	kilo-electron volts
LBGR	lower boundary of the gray region
LDR	land disposal restriction
LFE	LFE Environmental Analysis Laboratories, Inc.

ABBREVIATIONS AND ACRONYMS
(Continued)

LLCW	low-level combined waste
LLMW	low-level mixed waste
LLRW	low-level radioactive waste
LNAPL	light non-aqueous phase liquid
m	meter
m^2	square meters
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDA	minimum detectable activity
MDC	minimum detectable concentration
MDCR	minimal detectable count rate
MDER	minimum detectable exposure rate
MeV	mega-electron volts
min	minute
MLLW	mean lower low water
mR/hr	milliroentgen per hour
msl	mean sea level
NAVSEA	Naval Sea Systems Command
NaI	sodium iodide
NAVFAC SW	Naval Facilities Engineering Command, Southwest
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NIST	National Institute of Standards and Technology
NNPP	Naval Nuclear Propulsion Program
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRDL	Naval Radiological Defense Laboratory
NVLAP	National Voluntary Laboratory Accreditation Program
OSHA	Occupational Safety and Health Administration
pCi/g	picocurie per gram
pCi/L	picocurie per liter
pCi/mL	picocurie per milliliter
PESM	Project Environmental and Safety Manager

ABBREVIATIONS AND ACRONYMS
(Continued)

PjM	Project Manager
PPE	personal protective equipment
PQCM	Project Quality Control Manager
PRC	PRC Environmental Management, Inc.
PVC	polyvinyl chloride
QA	Quality Assurance
QC	Quality Control
^{226}Ra	radium-226
RAB	Restoration Advisory Board
RAO	removal action objective
RASO	Radiological Affairs Support Office
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
RHP	Radiological Health Program
RI	Remedial Investigation
ROC	radionuclide of concern
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager
RRO	radiological remedial objective
RSO	Radiation Safety Officer
RSS	Radiation Safety Section
RSY	Radiological Screening Yard
RTM	Radiological Task Manager
RWP	Radiation Work Permit
SAP	Sampling and Analysis Plan
SHSP	Site Health and Safety Plan
SHSS	Site Health and Safety Specialist
SOP	Standard Operating Procedure
^{90}Sr	strontium-90
STLC	Soluble Threshold Limit Concentration
SUPR	Survey Unit Project Report

ABBREVIATIONS AND ACRONYMS
(Continued)

SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TO	Task Order
Triple A	Triple A Machine Shop, Inc.
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, and disposal facility
TtEMI	Tetra Tech EM, Inc.
TtEC	Tetra Tech EC, Inc.
TtFW	Tetra Tech FW, Inc.
TTLC	Total Threshold Limit Concentration
USC	United States Code
VCP	vitrified clay pipe
VSP	Visual Sampling Plan
WB	California Water Board
WET	Waste Extraction Test
WMP	Waste Management Plan
ZOI	zone of influence

EXECUTIVE SUMMARY

This Project Work Plan for Base-wide Storm Drain and Sanitary Sewer Removal (Work Plan) describes the scope and approach for storm drain and sanitary sewer removal and radiological release of the excavation areas at Hunters Point Shipyard, San Francisco, California. The Department of the Navy, Naval Facilities Engineering Command, Southwest, and the Radiological Affairs Support Office are directing this removal action under the Department of Defense Installation Restoration Program in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act and the National Oil and Hazardous Substances Pollution Contingency Plan. Upon review of the site's radiological operational history, the *Final Historical Radiological Assessment, Volume II* (Naval Sea Systems Command, 2004) and site-specific investigative data, the Department of the Navy has determined that the storm drains and sanitary sewers contain radioactive material requiring a response action. This decision is documented in the *Final Basewide Radiological Removal Action, Action Memorandum-Revision 2006, Hunters Point Shipyard, San Francisco, California* (Department of the Navy, 2006), which was created to direct removal actions within areas throughout the base that contain radioactive contamination.

The Department of the Navy has initiated this removal action for the storm drains and sanitary sewer systems base-wide to substantially eliminate the potential threat posed by future migration or release of radioactive material present in the systems into the surrounding environment. Such a release could occur as a result of wastewater or stormwater transport, erosion, weathering, seismic events, or biological activity.

The removal action objectives are to protect public health and welfare and the environment and to preclude potential exposure to future residents or workers, by physically removing the existing storm and sanitary sewer lines and disposing of associated radioactive contaminants that exceed the radiological remedial objectives, thus substantially eliminating potential migration of contaminated material within or outside of the systems. The *Final Historical Radiological Assessment, Volume II* (Naval Sea Systems Command, 2004) identified cesium-137, radium-226, and strontium-90 as radionuclides of concern for the storm and sanitary sewer systems. The radiological remedial objectives that will be adopted have been established by the Department of the Navy in consonance with U.S. Environmental Protection Agency, Region IX. Meeting the specified radiological remedial objectives identified in the *Final Basewide Radiological Removal Action, Action Memorandum-Revision 2006, Hunters Point Shipyard, San Francisco, California* (Department of the Navy, 2006) is the purpose of this removal action.

This Work Plan reflects the radionuclides of concern specified in the *Final Historical Radiological Assessment, Volume II* (Naval Sea Systems Command, 2004) for the storm drain and sanitary sewer system. However, it was not intended to limit the removal action to those isotopes. Therefore, additional isotopes will be looked at during the performance of this work. The parcel-specific design plans will specify requirements and additional parameters to assess when working within the relevant radiologically impacted areas.

This Work Plan presents the overall scope and approach that will be implemented across Hunters Point Shipyard to perform the storm and sanitary sewer system removal and associated radiological screening, waste management, and site restoration activities. Storm drain and sanitary sewer systems will, to the extent practicable, be removed parcel by parcel or specified area. Parcel/area-specific design plans will be provided under separate cover to supplement the information provided in this Work Plan. The parcel/area-specific design plans will include unique implementation details including identification of specific storm and sewer lines to be removed, the relationship between the removal actions and existing environmental conditions, special construction requirements (if any), parcel/area-specific technical specifications, detailed design drawings, and data quality objectives.

While most storm and sanitary sewer piping within each parcel or area will be removed under this Work Plan, some piping may be left in place to be addressed at a later date and limited piping may be left in place permanently:

- Piping under the footprint of radiologically impacted buildings and outdoor areas will be evaluated as part of characterizing the building/area and will not typically be removed under this Work Plan.
- Piping laterals originating at non-radiologically impacted buildings will initially only be removed within the first 10 feet of their union with a main trunk line. If radiological contamination is not present in this segment of the line, then the exposed ends of the lateral will be capped or plugged and the remaining portions left in place. If evidence of radiological contamination is encountered, then the remainder of the lateral will be removed.

Exceptions to these criteria, if any, will be identified in the parcel/area-specific design plans.

The Department of the Navy will obtain all necessary authorizations and submit all necessary notifications prior to mobilization. Because this removal action is being performed in accordance with Section 121(e) of the Comprehensive Environmental Response, Compensation, and Liability Act to support a removal action, no permits are necessary. However, all substantive requirements of those permits will be met.

Mobilization activities will include tenant notifications, site preparation, moving equipment and material to the site, establishing radiological screening yard areas, and installing security fencing and runoff controls. Pre-excavation topographical and geophysical surveys may be performed to further refine the existing site conditions, if necessary.

The general approach to removing and surveying the storm and sanitary sewer lines will be to: 1) excavate soils, 2) remove the pipelines, 3) plug open sewer or storm drain lines left in place during the removal process to prevent water from entering or exiting pipes, 4) conduct ex-situ radiological screening and sampling of the pipeline, and 5) conduct Final Status Surveys of the excavated soils and exposed excavation trench surfaces. After the results of these activities are evaluated and any identified radiological contamination is removed, the trench excavations will be backfilled and the site restored.

Excavated soil overlying each storm and sanitary sewer line will be removed to a minimum of 1 foot below and to the sides of each storm drain and sanitary sewer pipeline. Soil excavated from within an identified Installation Restoration Program site will be stockpiled and sampled for the chemicals of concern prior to making a decision to either reuse the soil for trench backfill or dispose of the soil as waste, after screening in a radiological screening yard. Excavated soil from non-Installation Restoration sites will be stockpiled separately and used to backfill the excavations without additional chemical testing. Excavated soil will be radiologically surveyed and sampled for unrestricted use prior to stockpiling before chemical sampling.

After the soil is excavated and removed to a radiological screening yard, the pipelines will be removed. To the extent practicable, the pipeline materials will be removed separately. The interior surfaces of removed piping will be radiologically characterized by hand-survey and swipe sampling. Solid/sediment samples will be collected and analyzed for radiological contamination if a sufficient quantity is found to be present within the removed section of pipe. If the piping cannot be extracted separately from the excavated soil (i.e., terracotta) it will be managed separately as potentially contaminated material.

Excavated soil will be transported to a screening pad for subsequent dewatering (if necessary) and radiological surveys. Excavated soil placed on the screening pads will be spread out in lifts not to exceed 6 inches in height and up to 1,000 square meters in surface area. As necessary, the material will be allowed to dewater prior to the performance of radiological surveys. The radiological surface survey will consist of a high-density gamma scan performed with the use of sodium iodide detectors and supported by global positioning system equipment. A minimum of 18 solid samples will be collected for each survey unit of excavated soil (up to 1,000 square meters) placed on the screening pad. The samples will be systematically collected based on a random start point. Additional samples will be collected at locations where the investigation level is exceeded.

Final Status Surveys for every excavated pipeline trench section will include 100 percent scan and systematic and biased static measurements. Systematic post-excavation samples will be collected after establishing a grid that will not exceed 1,000 square meters over the excavated trench surfaces. A minimum of 18 systematically located samples will be collected from each trench section after it is completely excavated. These systematic samples will be analyzed for radionuclides by gamma spectroscopy (10 percent of the samples will also be analyzed for strontium-90) at the on-site laboratory, with 10 percent going to the off-site laboratory for quality assurance verification.

Final Status Survey sampling procedures are described in the Sampling and Analysis Plan provided in Appendix A. Final Status Survey results will be used for dose modeling and unrestricted release. Should radioactive material be detected within the trench, it will be removed and additional surveys/sampling will be performed.

When the results of the surveys and sampling confirm that contamination above the radiological remedial objectives has been removed, the excavation trenches will be backfilled. The primary source of backfill material is expected to be uncontaminated material removed from the excavations. In most areas of Hunters Point Shipyard, post-backfill site restoration will consist of installing surface drainage swales to direct overland stormwater runoff to outfalls along the San Francisco Bay shoreline, as appropriate. Installation of replacement subsurface stormwater piping will be limited to those areas where necessary to properly direct stormwater flows to San Francisco Bay. All installed drainage will comply with stormwater discharge requirements. The locations of subsurface replacement lines will be identified in the each specific design plan. No sanitary sewer lines will be replaced.

Radioactively contaminated material (system components, debris, excavated soils including mixed wastes, or incidental material) exhibiting concentrations above the radiological remedial objectives will be properly stored on site pending packaging, disposal, and transportation by an Army contractor in compliance with the Department of the Navy Low-level Radioactive Waste Disposal Program. Soils from within Installation Restoration Program sites not deemed suitable for reuse as backfill will be sent for off-site disposal. Large non-radioactive debris not suitable for replacement within the excavation area also will be sent for off-site disposal.

The results of the removal action will be documented in Survey Unit Project Reports that will be provided to regulatory agencies for review and acceptance as trenches are backfilled. These Survey Unit Project Reports will also be provided as Attachments in Parcel-specific Removal Action Completion Reports for presentation to the regulatory agencies and the Restoration Advisory Board.

1.0 INTRODUCTION

This Project Work Plan for Base-wide Storm Drain and Sanitary Sewer Removal (Work Plan) describes the scope and approach for the removal action for the sanitary sewer system and the storm drains at Hunters Point Shipyard (HPS), San Francisco, California (Figure 1-1). The Department of the Navy (DON), Naval Facilities Engineering Command, Southwest (NAVFAC SW), and the Radiological Affairs Support Office (RASO) are directing this removal action. This is the first revision to the Work Plan. The original version prepared under Contract No. N68711-93-D5713 and Contract Task Order (CTO) No. 0072 is hereby superseded. The Work Plan is being prepared under contract No. N62473-06-D-2201 and CTO No. 0006. The removal action may be performed under separate contract numbers and CTOs or Task Orders (TO).

This removal action is being conducted in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The DON will submit all necessary notifications prior to mobilization. Since this removal action is being performed in accordance with Section 121(e) of the CERCLA, no permits are necessary. However, all substantive requirements of those permits will be met.

Based on the site's radiological operational history described in the *Final Historical Radiological Assessment, Volume II* (HRA) (Naval Sea Systems Command [NAVSEA], 2004) and site-specific investigative data, the DON has determined that this site contains radioactive contamination in soils and debris requiring a response action. This decision is documented in the *Final Basewide Radiological Removal Action, Action Memorandum-Revision 2006, Hunters Point Shipyard, San Francisco, California* (referred to hereafter as the Action Memorandum [AM]) (DON, 2006), which was created to direct removal actions within areas throughout the base that contain localized radioactive contamination.

The DON has initiated this removal for the extraction of piping systems and soil containing radioactive contaminants that may be present in or around the sanitary sewers and storm drain systems. This removal action will serve to eliminate the potential threat posed by future migration and/or off-site release of radioactive material present at the site to the surrounding environment. Currently, such a release could occur as a result of wastewater or stormwater transport, erosion, weathering, seismic events, or biological activity.

The HRA (NAVSEA, 2004) listed cesium-137 (^{137}Cs), radium-226 (^{226}Ra), and strontium-90 (^{90}Sr) as radionuclides of concern (ROCs) for the storm and sanitary sewer systems. All radioactive materials encountered during the removal action above the radiological remedial objectives (RROs) will be remediated for disposal as radioactive waste. The radiological surveying and characterization sampling will be conducted in accordance with the *Base-wide Radiological Work Plan, Revision 1* (Base-wide Plan, Rev. 1; Tetra Tech EC, Inc., 2007).

This Work Plan describes the overall scope and approach to the removal action and details the specific activities involved in implementation of the planned removal action. Parcel or area specific design plans will be provided under separate cover and will include site and detail design drawings, specifications, and data quality objectives (DQOs) to address the details of each work area.

1.1 REMOVAL ACTION OBJECTIVES

The removal action objectives (RAOs) are to meet the RROs, and to protect public health and welfare and the environment by physically removing and disposing of radioactive contaminants that exceed the RROs, thus substantially eliminating potential migration of contaminated material within or outside of the systems. The RROs that will be adopted have been established by the DON in consonance with U.S. Environmental Protection Agency (EPA), Region IX. Meeting the specified RROs and achieving unrestricted radiological release for the area is the purpose of this removal action.

1.2 SCOPE OF WORK

The scope of the removal action includes preparation of and updating this Work Plan, preparation of parcel or area-specific design plans, performance of construction activities, preparation of Survey Unit Project Reports (SUPRs) for each backfilled trench section, and preparation of Parcel-specific Removal Action Completion Reports. This Work Plan will define the work at a summary level whereas the parcel or area-specific design plans will provide the details for the removal and construction process. Prior to invasive work, notifications will be issued, procurements completed, and equipment and personnel mobilized. The major field activities associated with the removal action include clearing of vegetation and or pavement; geophysical investigations and utility clearance of excavation areas; establishment of soil and debris stockpile areas and radiological screening yards (RSYs); excavation of impacted sanitary sewer and storm drain piping and associated components; ex-situ survey of excavated material; sampling, segregation, and stockpiling of contaminated soil and debris; in-situ surveys of remaining soils; post-excavation radiological sampling; backfill and compaction with non-impacted excavated soils or clean import material; establishment of new storm drainage system/site restoration; and waste transportation and disposal. Field activities will be completed upon decontamination and demobilization of project equipment and personnel.

Upon completion of excavation activities for each individual trench unit, a SUPR will be prepared and submitted to the regulatory agencies for review. Following completion of each parcel or area-specific removal action, a Parcel-specific Removal Action Completion Report will be prepared to document that the fieldwork has resulted in completion of the RAOs and each individual SUPR will be provided as an Attachment to this report. The report will be provided to the responsible regulatory agencies and the Restoration Advisory Board (RAB).

1.3 SITE SAFETY

Occupational Safety and Health Administration (OSHA) excavation regulations and permit requirements will be followed. All excavations will be conducted in accordance with California Health and Safety Code, California Code of Regulations (CCR) Title 8, Sections 1539 through 1541, and 29 Code of Federal Regulations (CFR), Parts 1910 and 1926, requirements. All field activities will be conducted in accordance with the Draft Site Health and Safety Plan (SHSP) (TtEC, 2006), which has been prepared as a stand-alone document.

1.4 RADIOLOGICAL CONTROL PRACTICES

TtEC has a Nuclear Regulatory Commission (NRC) Type A Broad Scope License. (A similar license may also be held by a subcontractor working for TtEC under this Work Plan.) Radiological control measures will be implemented by TtEC (or their subcontractor) in accordance with the license. TtEC will ensure that the radiological control program and work practices are implemented and performed in accordance with acceptable industry standards and the applicable NRC license requirements. Work performed under this Work Plan and any radioactive materials identified and stored for subsequent disposal will be done so in accordance with the NRC license requirements.

This work will be performed under New World Environmental, Inc., d.b.a New World Technology, NRC Type A Broad Scope License Number 04-27745-01.

1.5 PROJECT ORGANIZATION AND SCHEDULE

The completion schedules for each parcel or defined work area will be presented in their respective design plans.

The DON Remedial Project Manager (RPM) for this project is Mr. Ralph Pearce, who is responsible for project management, budget control, schedule maintenance, and coordinating project survey plans, reports, and negotiations with regulatory agencies. Mr. Pearce is also responsible for community relations and ensuring that the field and remedial activities comply with the applicable rules and regulations. Mr. Mike Mentink and Mr. Doug Delong of the Caretaker Site Office (CSO) are responsible for coordination of field activities. Mr. Peter Stroganoff is the Resident Officer in Charge of Construction (ROICC), responsible for technical oversight and quality control (QC). Ms. Laurie Lowman is the technical lead for the RASO and is responsible for the technical oversight and review of the project documents and all issues related to radiological activities. The RASO acts as the lead interface with regulatory agencies on radiological issues, survey plans and reports, and radiological release criteria.

The TtEC Storm Drain/Sanitary Sewer Removal Project Manager (PjM) will be responsible for general project administration. The PjM oversees budget, schedule, and document preparation, and will ensure the quality of all project-related activities and deliverables.

The TtEC Site Superintendent will manage the fieldwork, provide oversight to subcontractors, and is responsible for managing the on-site technical aspects of the project and coordination with the CSO, ROICC, Site Health and Safety Specialist (SHSS), RASO, and PjM.

A Project Quality Control Manager (PQCM) to coordinate with the TtEC QC Program Manager and the NAVFAC SW Quality Assurance (QA) Officer to ensure that all field activities comply with the project specifications. A Senior SHSS will be on site during field activities and will be responsible for ensuring that field activities are conducted in compliance with the SHSP (TtEC, 2006). The SHSS will coordinate with the Certified Industrial Hygienist (CIH).

An on-site Radiation Safety Officer (RSO) shall be appointed to manage any subcontractors and the on-site radiological program in coordination with the assigned Certified Health Physicist (CHP). A Radiological Task Manager (RTM) will be responsible for ensuring that all radiological operations are performed in compliance with the NRC license and applicable Radiological Health Program (RHP) and that RHP policies and guidelines are followed. Additional support will be provided by other engineering and technical resources. A project organization chart showing the relationship among select team members is provided as Figure 1-2.

The following is a list of the key project contacts:

Agency	Contact	Project Title
NAVFAC SW 1455 Frazee Road, Suite 900 San Diego, CA 92108-4310	Ralph Pearce (619) 532-0912 ralph.pearce@navy.mil	DON RPM
Naval Sea Systems Command (NAVSEA) Detachment (DET) RASO Building 1971 NWS P.O. Box Drawer 260 Yorktown, VA 23691-0260	Laurie Lowman (757) 887-4692 laurie.lowman@navy.mil	Radiological Site Manager
NAVSEA DET RASO Building 1971 NWS P.O. Box Drawer 260 Yorktown, VA 23691-0260	Matthew Slack (757) 887-4692 matthew.slack@navy.mil	Assistant Radiological Site Manager
NAVFAC SW 1220 Pacific Highway San Diego, CA 92132-5190	Narciso Ancog (619) 532-2540 narciso.ancog@navy.mil	Quality Assurance Officer
NAVFAC SW ROICC San Francisco Bay Area 2450 Saratoga Avenue, Building 110, Suite 200 Alameda, CA 94501-7545	Peter Stroganoff (510) 759-5941 peter.stroganoff@navy.mil	ROICC
NAVFAC ROICC San Francisco Bay Area 2450 Saratoga Avenue, Building 110, Suite 200 Alameda, CA 94501	Andy Uehisa (510) 749-5946 andrew.uehisa@navy.mil	ROICC Construction Management Technician

Agency	Contact	Project Title
CSO Hunters Point Shipyard 410 Palm Avenue, Building 1, Suite 161 San Francisco, CA 94130	Mike Mentink (415) 743-4729 mike.mentink@navy.mil	CSO
CSO Hunters Point Shipyard 410 Palm Avenue, Building 1, Suite 161 San Francisco, CA 94130	Doug Delong (415) 743-4713 doug.delong@navy.mil	CSO
EPA, Region IX 75 Hawthorne Street (SFD-8-1) San Francisco, CA 94105-	Mark Ripperda (415) ripperda.mark@epamail.epa.gov	EPA RPM
California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) Office of Military Facilities 700 Heinz Ave., Building F, Suite 200 Berkeley, CA 94710	Tom Lanphar (510) 540-3776 tlanphar@dtsc.ca.gov	Cal/EPA DTSC RPM
California Water Board (WB) 1515 Clay Street, Suite 1400 Oakland, CA 94312	Jim Ponton (510) 622-2492 jponton@waterboards.ca.gov	WB RPM
TtEC Hunters Point Shipyard 270 Nimitz Avenue, Building 270 San Francisco, CA 94124	William Dougherty (415) 216-2731 bill.dougherty@tteci.com	Project Manager
TtEC 1050 NE Hostmark Street, Suite 202 Poulsbo, WA 98370	Gregory Joyce (360) 598-8117 (360) 780-0371 (cellular) greg.joyce@tteci.com	QC Program Manager
TtEC 1940 E. Deere Ave., Suite 200 Santa Ana, CA 92705-5718	Lisa Bienkowski (949) 756-7592 lisa.bienkowski@tteci.com	Project Chemist
TtEC Hunters Point Shipyard 270 Nimitz Avenue, Building 270 San Francisco, CA 94124	Jeff Bray (415) 671-1990 jeff.bray@tteci.com	Site Superintendent
TtEC Hunters Point Shipyard 270 Nimitz Avenue, Building 270 San Francisco, CA 94124	James Chang (415) 816-8085 Jim.chang@tteci.com	Project Engineer
TtEC Hunters Point Shipyard 270 Nimitz Avenue, Building 270 San Francisco, CA 94124	Greg Joyce (360) 598-8117 greg.joyce@tteci.com	PQCM

Agency	Contact	Project Title
TtEC Hunters Point Shipyard 270 Nimitz Avenue, Building 270 San Francisco, CA 94124	Daryl DeLong (415) 671-1990 daryl.delong@tteci.com	RSO
TtEC Hunters Point Shipyard 270 Nimitz Avenue, Building 270 San Francisco, CA 94124	Neil Tsubota (415) 216-2736 (415) 676-9179 (cellular)	Senior SHSS
TtEC 1230 Columbia Street, Suite 750 San Diego, CA 92101-8536	Roger Margotto CIH, CSP, CHMM (619) 471-3503 roger.margotto@tteci.com	Project Environmental and Safety Manager/CIH
TtEC 3200 George Washington Way, Suite G Richland, WA 99352	Cliff Stephan (509) 371-0140 cliff.stephan@tteci.com	Project CHP
New World Technology Hunters Point Shipyard 270 Nimitz Avenue, Building 270 San Francisco, CA 94124	John Polyak (415) 216-2767 jrpolyak@juno.com	RTM

1.6 PROJECT WORK PLAN ORGANIZATION

This Work Plan includes the following sections:

- **Section 1.0, Introduction** – Section 1.0 provides the RAOs of the project, the scope of work, and the organization of the Work Plan.
- **Section 2.0, Site Description and Background** – Section 2.0 includes a description of the environmentally sensitive areas, background on the sewer and storm drain systems, and summarizes previous investigations relevant to the project.
- **Section 3.0, Regulatory Framework** – Section 3.0 describes the regulatory process, RAOs, regulated site activities, anticipated waste streams, and potential federal and state applicable or relevant and appropriate requirements (ARARs).
- **Section 4.0, Radiological Control Plan** – Section 4.0 outlines the radiological procedures relevant to this removal action.
- **Section 5.0, Final Status Surveys** – Section 5.0 outlines the Final Status Survey (FSS) Design relevant to this removal action.
- **Section 6.0, System Description** – Section 6.0 provides a general description of the storm drain and sanitary sewer systems.
- **Section 7.0, Field Implementation** – Section 7.0 describes the actions and methods to be applied to storm drain and sewer removal on a base-wide basis.

- **Section 8.0, Waste Management Plan** – Section 8.0 presents the waste management practices and procedures to be followed for the types and quantities of waste expected to be generated during the field activities associated with the removal activities during the base-wide sanitary and storm drain system radiological characterization and remediation.
- **Section 9.0, Environmental Protection Plan** – This section presents information regarding the environmental management program for the base-wide sanitary and storm drain system radiological characterization and remediation. The purpose of this Environmental Protection Plan (EPP) is to detail the means of compliance with the ARARs for the remediation effort.
- **Section 10.0, References** – Section 10.0 includes the documents used to prepare this Work Plan.
- **Attachment 1** – Attachment 1 is the Procedure for Buried Drums, Bottles, Jars, and Containers with Unknown Content.
- **Appendices**
  - Appendix A – Sampling and Analysis Plan (SAP)
  - Appendix B – Project Contractor Quality Control Plan
  - Appendix C – Stormwater Pollution Prevention Plan (SWPPP)

2.0 SITE DESCRIPTION AND BACKGROUND

HPS is a former DON shipyard located in the southeast portion of the City of San Francisco along the Bay (see Figure 1-1). This section includes a description of site hydrology, environmentally sensitive areas, land usage, and background relevant to the sanitary sewer and storm drain systems.

2.1 SITE DESCRIPTION

HPS is located on a long promontory in the southeastern part of San Francisco that extends east into San Francisco Bay. Presently, HPS encompasses approximately 848 acres, including approximately 416 acres on land. The land portion of HPS was purchased by the DON in 1939 and leased to Bethlehem Steel Corporation. At the start of World War II in 1941, the DON took possession of the property and operated it as a shipbuilding, repair, and maintenance facility until 1974 when the DON deactivated HPS. From 1976 to 1986, the DON leased HPS to Triple A Machine Shop, Inc. (Triple A), a private ship repair company. In 1986, Triple A ceased operations and the DON resumed occupancy through 1989. In 1991, HPS was placed on the DON's Base Realignment and Closure (BRAC) list and its mission as a DON shipyard ended in April 1994.

HPS was divided into six parcels, Parcels A through F. In November 2004, Parcel A was transferred to the City and County of San Francisco. In 2004, the DON subdivided Parcel E, creating Parcel E-2 (see Figure 1-1).

2.2 HYDROLOGY

HPS straddles two of the seven San Francisco groundwater basins: the Islais Valley Groundwater Basin, which lies to the northeast, and the South Groundwater Basin, which lies to the southwest.

The City and County of San Francisco supply the potable water used at HPS. Groundwater from HPS is not used for domestic purposes. There are no reports of operational water supply wells within 1 mile of HPS. All wells at HPS are groundwater monitoring wells.

2.2.1 Groundwater at HPS

An A-aquifer, a B-aquifer, and one bedrock water-bearing zone have been identified at HPS. The A-aquifer is generally unconfined, consisting of artificial fill and Undifferentiated Upper Sand Deposits overlying Bay Mud, and is unconfined and shallow with depths to groundwater ranging from 2 to 17 feet below ground surface (bgs). Recharge is from precipitation infiltration, Bay water, and to a lesser extent leaks from water and storm drain lines.

An aquitard separates the A-aquifer from the B-aquifer, forming a vertical hydraulic barrier between the A- and B-aquifers and confining the B-aquifer to saturated, porous Undifferentiated Sedimentary Deposits lying between the aquitard and the bedrock water-bearing zone. Water in the A- and B-aquifers generally flows toward the Bay portions of saturated bedrock not in direct contact with the A- or B-aquifers. The A- and B-aquifers are hydrostratigraphically classified as bedrock water-bearing zones. Groundwater within the shallow aquifer is unsuitable for use as a potable water supply.

2.2.2 San Francisco Bay Dynamics

Tidal range at the Golden Gate Strait varies from plus 7 feet to minus 1.1 feet compared with mean sea level (msl). While Bay currents at the Golden Gate Strait reach 4 miles per hour, currents near HPS average less than 2 miles per hour. Winds seldom exceed 20 miles per hour and are predominantly a westerly onshore flow (blowing off the ocean from west to east).

The Sacramento and San Joaquin rivers contribute about 90 percent of the estimated 750 billion cubic feet of inflow to the Bay. Other sources include the Petaluma, Guadalupe, and Napa rivers; Alameda and San Lorenzo creeks; and Coyote Creek, Redwood Creek, and San Francisquito Creek.

2.3 ENVIRONMENTALLY SENSITIVE AREAS

Environmentally sensitive areas are located on and in the vicinity of HPS. Two types of wetland habitat, saline-emergent wetland (coastal salt marsh) and small seasonal freshwater wetland are found in the several small wetland areas along the undeveloped southern HPS shoreline in Parcel E. These areas provide the greatest ecological diversity of any habitat at HPS. Several small areas of saline-emergent wetland are located within the intertidal zone along the Bay shoreline edges. Plant species observed in these areas during a February 1997 field survey included pickleweed (*Salicornia virginica*), salt grass (*Distichlis spicata*), and cordgrass (*spartina foliosa*).

A small freshwater emergent wetland area, supported by a small intermittent freshwater source, is located on approximately 1 acre in Installation Restoration (IR) Site 01/21 (IR-01/21). Observed plant species in this wetland include the toad rush (*Juncus* sp.), umbrella sedge (*Cyperus laevigatus*), Pacific Coast bulrush (*Scirpus robustus*), and rabbit's-foot grass (*Polypogon monspeliensis*).

Waterfowl, shorebirds, and wading birds may use wetland habitats as a source of food, cover, and water. The following animal species were observed at HPS during the February 1997 field survey: the common snipe (*Gallinago gallinago*), greater yellowlegs (*Tringa melanoleuca*), killdeer (*Charadrius vociferus*), mallard (*Anas platyrhynchos*), great blue heron (*Ardea herodias*), and great egret (*Casmerodius albus*). The abundance of shorebirds may serve as prey for raptors, such as the endangered peregrine falcon (*Falco peregrinus*). Small animals, such as the raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*) and the burrowing owl (*Athene cunicularia*), may forage in or along the edges of wetland habitat. Harbor seals (*Phoca vitulina richardsi)* are known to feed in the waters off HPS.

Parcel-specific design plans will include a drawing or figure that depicts the relation of environmentally sensitive areas and the proposed remedial action areas.

2.4 ADJACENT LAND USAGE

Development of land surrounding the HPS site during the past 60 years has consisted of light and heavy industrial facilities, other shipyards, commercial fishing operations, and some residential dwellings. The rapid growth of the shipyard and its support facilities during World War II fueled the buildup of housing and commercial enterprises in the immediate vicinity of HPS to support the increased workforce at the yard.

The San Francisco Housing Authority public housing, Hunters Point A-West, E-West, Hunters View, and Westbrook, are located in the immediate vicinity of HPS. These communities form a large housing area, part of which is adjacent to the HPS entrance gate. Other surrounding areas contain a mixture of light and heavy industries, including automobile recycling, repair shops, and food manufacturers. Retail ventures, including stores and restaurants, are also located within 1 mile of HPS.

Each parcel-specific design plan will include an evaluation of the removal action in relation to facilities with sensitive receptors such as schools or day care centers. If these sites are within 1 mile of the removal action and could be potentially impacted, they will be identified in the applicable parcel-specific design plan.

2.5 CURRENT AND FUTURE HPS USAGE

For over 20 years, the DON has leased many HPS buildings to private tenants and DON-related entities for industrial and artistic uses, including storage space, art studios, machine workshops, woodworking shops, automobile restoration garages, recreational vehicle parking, and filming of movies.

Non-licensed radioactive material is in use at HPS in thoriated welding rods, building smoke detectors, and radiation survey instrument check sources used by remediation contractors.

Most HPS tenants have been notified that they must leave HPS prior to the start of activities under this Work Plan to ensure that operations can be performed safely. Those tenants that will remain at HPS during the storm drain and sewer line removal actions will be required to temporarily relocate outside of active work areas.

After this removal action and other remedial activities are completed, portions of HPS will be transferred to the City and County of San Francisco for conversion to non-defense reuse. The City's reuse plan identifies a wide range of planned reuse opportunities across HPS, including residential, commercial, mixed use (residential/commercial), industrial, maritime, and open space.

2.6 STORM DRAIN AND SANITARY SEWER SYSTEMS BACKGROUND

The present-day configuration of the sanitary and stormwater sewer system is the result of an evolutionary process. This system was originally designed and built in the 1940s as a combined system, using the same conveyance piping and 40 separate discharge outfalls into the Bay. This combined system grew in sections from the 1940s to its maximum size in 1958, when it underwent the first in a series of separation projects. The Building 819 pump station was constructed for conveyance of much of the sanitary sewage from HPS to the City of San Francisco treatment works, and separation of the systems took place in the industrial areas and the southwest area of HPS. Separation of the systems involved installation of dedicated sanitary sewer collection piping or diversion structures within the combined system. Twenty-eight Bay outfalls were converted for exclusive use for stormwater outlets, while 12 continued to serve as combined sanitary and stormwater sewer outlets. In 1973, the second segregation project was undertaken. This project removed some of the stormwater outfalls from the South Basin Area, just offshore from the Parcel E shoreline. The last of the separation projects performed in 1976 involved the installation of additional dedicated sanitary sewer piping. Complete separation of the combined systems was never achieved. Due to the evolutionary nature of the separation process, radiological contamination from the same source could have impacted the piping and other components of both systems.

2.7 PREVIOUS INVESTIGATIONS

Since the beginning of radiological operations at HPS in 1946, radiological investigations and removal actions have been conducted by various groups and regulatory agencies to assess and remove residual general radioactive materials (G-RAM) resulting from these operations. Naval Radiological Defense Laboratory (NRDL), DON contractors, regulatory agencies, and the RASO have conducted various radiological surveys and studies to evaluate residual radioactive contamination and risks from radiological operations at HPS through the years. These investigations and surveys include:

- 1946 through 1948 Radiation Safety Section (RSS) and NRDL surveys and decontamination of OPERATION CROSSROADS ships and drydocks
- 1955 NRDL surveys to decommission NRDL buildings at HPS
- 1969 NRDL survey for dis-establishment of NRDL

- 1969 to 1970 Atomic Energy Commission (AEC) survey to verify NRDL's survey results and release buildings for reuse
- 1974 HPS survey for base closure
- April 1978 LFE Environmental Analysis Laboratories, Inc. (LFE), survey of Building 815
- July 1978 RASO survey of Building 815 to confirm LFE survey findings
- September 1978 RASO survey of former NRDL buildings
- 1979 RASO resurvey of Buildings 364, 815, and 816
- 1986 EPA harbor survey at Naval Nuclear Propulsion Program's (NNPP's) request
- 1988 to 1989 Harding Lawson Associates (HLA) site reconnaissance
- 1991 to 2001 surveys conducted for the Remedial Investigation (RI) program in four phases: Phases I through IV, including the following interim investigations:
  - 1997 Parcel E radiation risk assessment
  - 1999 to 2001 interim investigations between the Phase IV and Phase V investigations
- 2001 to 2003 Phase V investigations and removal actions

Based on these investigations, radiologically impacted areas and buildings have been delineated as shown in Figure 1-1.

3.0 REGULATORY FRAMEWORK

Environmental investigation and remediation activities are being conducted at HPS under the Department of Defense (DoD) Installation Restoration Program (IRP) in accordance with CERCLA and the NCP. Under Executive Order 12580, the DON is the lead agency responsible for implementation of the IRP and the removal action. The EPA is the lead regulatory agency, while the California DTSC and WB, San Francisco Bay Region, will provide state regulatory oversight.

3.1 REGULATORY PROCESS

The DON is directing this removal action under the DoD IRP in accordance with requirements of CERCLA and the NCP. This removal action is being conducted in accordance with the AM (DON, 2006).

The City of San Francisco, EPA, DTSC, WB, and the Department of Health Services (DHS) have all provided input to the DON, which serves as the lead agency for the cleanup. Input is provided through the Base Cleanup Team meetings, as well as through comments to this Work Plan. The agencies are responsible for ensuring that the cleanup proceeds in accordance with the substantive requirements of the applicable regulations.

The base-wide sanitary and storm drain system and radiological characterization and remediation will be conducted pursuant to CERCLA and the NCP under the delegated authority of the Office of the President of the United States by Executive Order 12580. In accordance with Section 300.415(b) of the NCP, the AM (DON, 2006) has been presented by the DON for this removal action.

3.2 REMOVAL ACTION OBJECTIVES

Consistent with the NCP requirements in Title 40 CFR, Part 300.415(b)(2), the RAOs for this removal action are to implement the AM (DON, 2006) and protect public health and welfare and the environment by physically removing and disposing of radioactive contamination that exceeds the RROs presented in Table 3-1. This substantially eliminates potential migration of radioactive material within or outside of the site. Meeting the currently specified RROs and achieving unrestricted radiological release is the purpose of this removal action. Some radiologically impacted sites have ROCs associated with the site that are not included in Table 3-1. The lateral piping associated with these sites may impact the main drainage lines. Each individual Design Plan will address any additional ROCs that may be present.

3.3 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Section 121(d) of CERCLA 1980 (CERCLA, 42 United States Code [USC], Section 9621[d]), as amended, states that remedial actions at CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environmental standards, requirements, criteria, or limitations determined to be legally applicable or relevant and appropriate. Although Section 121 of CERCLA does not itself expressly require that CERCLA removal actions comply with ARARs, the EPA has promulgated a requirement in the NCP mandating that CERCLA removal actions ". . . shall, to the extent practicable considering the exigencies of the situation, attain ARARs under federal environmental or state environmental or facility siting laws" (Title 40 CFR, Part 300.415[j]). It is DON policy to follow this requirement. Certain specified waivers may be used for removal actions, as is the case with remedial actions.

The NCP defines applicable requirements as cleanup standards, standards of control, and other substantive environmental protection requirements, criteria or limitations promulgated under federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstances at a CERCLA site (40 CFR 300.5).

The NCP defines relevant and appropriate requirements as cleanup standards, standards of control and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that, while not expressly stated as applicable to a hazardous substance, pollutant or contaminant, remedial action, location, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site and are well-suited to the particular site (40 CFR 300.5).

In accordance with the NCP requirements, the ARARs are presented in the AM (DON, 2006). The chemical-, location-, and action-specific ARARs presented in the AM (DON, 2006) and identified as applicable to this removal action are presented below. Summaries of the potential chemical-specific, location-specific, and action-specific ARARs are included in Tables 3-2, 3-3, and 3-4, respectively.

Chemical-specific ARARS

- Resource Conservation and Recovery Act (RCRA) hazardous waste identification requirements (42 USC, Chapter 82, 6901-6991[I], CCR, Title 22, 66261.21, 66261.22 [a][1], 66261.23, 66261.24[a][1], and 66261.100)
- Standards Applicable to Generators of Hazardous Waste (CCR, Title 22, Division 4.5, Chapter 12, Article 1)

Location-specific ARARs

- Federal Coastal Zone Management Act (16 USC 1451–1464)
- Executive Order No. 11990, Protection of Wetlands

- Clean Water Act of 1977, as amended, Section 404 (33 USC 1344)
- Porter-Cologne Water Quality Control Act, California Water Code Division 7
- San Francisco Bay Water Quality Control Plan (WB, 1995)
- Endangered Species Act of 1973 (16 USC 1531–1543)

Action-specific ARARs

- Requirements under RCRA for disposal of hazardous waste on land (Title 22 CCR 66268.7). This ARAR was originally listed as chemical-specific in the AM (DON, 2006).
- Storage and Control of Licensed Material (10 CFR Part 20 Subpart I, 20.1801)
- Clean Air Act excavation requirements (42 USC 7401 et seq., Bay Area Air Quality Management District [BAAQMD] Regulations 6-301, 6-302, and 6-305, Regulation 8-40)
- Requirements under RCRA for disposal of hazardous waste on land (Title 22 CCR 66268.7)
- State Water Resources Control Board (SWRCB) Order 99-08 adopted pursuant to Title 40 CFR Part 122, Subpart G
- Federal Hazardous Materials Transportation Law hazardous materials transportation requirements (49 USC 5101-5127, 49 CFR 171.2[g], 172.300-172.304, 17.312, 172.400, 172.504)

3.4 CLEANUP GOALS

The HRA (NAVSEA, 2004) identified ^{226}Ra, ^{137}Cs, and ^{90}Sr as ROCs. Prior radiological investigations have confirmed the presence of ^{226}Ra and ^{137}Cs within the sanitary sewer and storm drain systems. The presence of other radionuclides, such as ^{90}Sr, will be assessed during the screening activities conducted as part of this removal action. Table 3-1 provides the RROs for the ROCs. If additional radionuclides are encountered, the cleanup goals established in the AM (DON, 2006) will be adopted. Any remaining contamination at the site will be addressed though the IRP process, consistent with CERCLA and NCP.

4.0 RADIOLOGICAL CONTROL PLAN

All general provisions of the Base-Wide Plan, Rev. 1 (TtEC, 2007) shall be applied to work done under this Radiological Control Plan. This includes the requirement for Work Plans, Radiation Work Permits (RWPs), and work being conducted under the limitations of an NRC license when applicable.

Specific radiological control measures applicable to each parcel or work area shall be stated under the appropriate design plan. Additional radiological controls may also be specified in work-specific plans for particular sanitary and storm drain runs.

4.1 RADIOLOGICAL HEALTH AND SAFETY

The TtEC Standard Operating Procedures (SOPs) and SHSP (TtEC, 2006) will be used to address controls necessary for radiologically safe operations. An SHSS will be present at all active work areas to ensure that work is conducted in a safe manner.

Personnel assigned to site work will be required to understand the requirements and sign the RWP prior to beginning work. RTMs will manage implementation of the radiological aspects of Work Plans. RWP compliance will be monitored by a Radiological Control Technician (RCT) to be present during all work activities. License compliance shall be ensured by the subcontractor and TtEC RSOs.

Dose rate, contamination, and air monitoring will be performed as necessary. Personal protective equipment (PPE) levels, dictated by radiological considerations and physical and chemical safety issues identified at each work location, will be assigned or modified, according to the approved RWP and SHSP (TtEC, 2006).

4.2 ALARA

All work to be performed under this plan shall employ the basic as low as reasonably achievable (ALARA) concept. The ALARA concept of radiation protection specifies that exposures to ionizing radiation and releases of radioactive material should be managed to reduce collective doses to workers and the general public ALARA.

4.3 TRAINING

The minimum training requirements for personnel working in the field include the following:

- OSHA 40-Hour and Annual 8-Hour Refresher
- Radiation awareness training
- RWP and Work Plan training for the specific site or task

- Activity Hazard Analysis (AHA) training for the specific site or task
- SHSP training, as required by the plans

Additional training and experience is required for personnel responsible for radiological activities.

4.4 WHOLE-BODY DOSE MONITORING

Dosimeters shall be issued and worn by all personnel performing fieldwork under this plan. The dosimeters shall be National Voluntary Laboratory Accreditation Program (NVLAP)-approved and obtained from an NVLAP-certified provider. Personnel issued dosimetry must complete an NRC Form 4. The original Form 4 will be maintained by the organization issuing the dosimetry with a copy or the original kept at the project field office at HPS.

4.5 RADIATION WORK PERMITS

An RWP will be prepared that will specify the radiological safety requirements for activities performed under this Work Plan. Personnel assigned to site work will be required to understand the requirements and sign the RWP prior to beginning work. Further discussion of the RWP and the procedures required to generate one are given in the Base-wide Plan, Rev. 1 (TtEC, 2007) and, as applicable, the TtEC SOP governing issue and use of RWPs.

4.6 RADIOLOGICAL CONTROL PROCEDURES

The day-to-day management of radioactive material is governed by program criteria detailed in the Base-wide Plan, Rev. 1, and as applicable, the TtEC SOP governing control of radioactive material.

Only pre-authorized areas will be used to store radioactive materials at HPS. These areas will be selected with concurrence of the RASO, RPM, and CSO. Security measures for these areas will be coordinated with the CSO and TtEC or subcontractor NRC licensee.

Radioactive material handling activities must be performed in a manner to ensure the following:

- Access to areas and/or rooms is restricted where radioactive materials are known to be present.
- Surveys of radioactive materials storage areas are completed at least weekly.
- Radioactive material inventories are kept up-to-date.

4.7 INVESTIGATION LEVELS

Investigation levels are specific levels of radioactivity used to indicate when additional investigation may be necessary. Investigation levels also serve as a QC check. For example, in addition to indicating potential contamination, a measurement that exceeds the investigation level may indicate a failing instrument.

When determining an investigation level using a statistical-based parameter (for example, standard deviation), the following may be considered: survey objectives, underlying radionuclide distributions (for example, normal, log normal, non-parametric), data population descriptors (for example, standard deviation, mean, median), and prior survey and historical information.

When an investigation level is exceeded, the measurement will be confirmed to ensure that the initial measurement/sample actually exceeds the particular investigation level. This will involve taking further measurements to confirm the initial result, and as appropriate, to quantify the area of elevated residual radioactivity.

4.7.1 Investigation Levels for Gamma Radiation Surveys

For gamma surveys, the investigation level will normally be established at the reference area mean + 3σ, where σ is the standard deviation of the gamma readings in the reference area.

4.7.2 Investigation Levels for Alpha and Beta Radiation Surveys

For alpha and beta surveys, the investigation level will be the release criteria or a statistical-based parameter (e.g., reference area mean + 3σ), if used.

4.8 RADIATION DETECTION INSTRUMENTATION

Various instruments will be used to detect the radioactive material known or suspected to be present within the sanitary sewer and storm drain systems. Instrument calibration, performance checks, and operation shall be done 1) as applicable, with TtEC SOP(s) governing preparation of portable radiation and contamination survey meters and instruments for field use, and 2) in accordance with any additional instructions specified in the design plans. The instruments selected shall be able to detect the radionuclides of concern (^{137}Cs, ^{226}Ra, and ^{90}Sr) and shall, in relation to the survey or analytical technique, be capable of measuring levels sufficient to support the DQOs presented in the SAP (Appendix A, Table A.3-1). Table 4-1 identifies the instrumentation that may be used for radiological surveys, unless another ROC is identified in the design plan.

Radiation detection instrumentation used during the survey will be maintained and calibrated to operate within manufacturers' specifications, so that the required sensitivity and precision will be maintained. Specific calibration and maintenance will be conducted by personnel familiar with the equipment or by manufacturers' technical representatives.

Operational procedures have been developed for all field equipment to verify that the equipment is operating properly and that the data will be valid with instrument-traceable calibrations. These procedures include functional operational checks, routine maintenance, calibration procedures, and operational instructions.

Instrumentation used during the FSS will be field-checked prior to starting work, mid-day, and at the end of the day. All of the instruments are required to be within the +/- 20 percent criteria established when setting up background information for them. If an instrument does not meet the criteria, it will be removed from service and returned to the manufacturer for maintenance.

4.8.1 Instruments for Static and Scan Surveys for Alpha and Beta Activity

Alpha and beta radiation measurements will be performed using either a Ludlum Model 2350-1 or Ludlum Model 2360 data logger (or equivalent) equipped with either a Ludlum Model 43-68 gas-proportional probe or a Ludlum Model 43-89 zinc sulfide plastic scintillation detector (or equivalent).

4.8.2 Instruments for Static and Scan Surveys for Gamma Activity

Direct measurement and scan surveys for gamma radiation will be performed using a Ludlum Model 2350-1 data logger or Model 4612 (or equivalent) equipped with a Ludlum Model 44-10 2-inch by 2-inch sodium iodide (NaI) scintillation detector (or equivalent).

4.8.3 Instruments for Direct Measurement Surveys for Beta Gamma Activity

Direct measurement surveys for beta and gamma radiation will be performed using Ludlum Model 3 (or equivalent) with a Model 44-9 Geiger-Mueller pancake probe (or equivalent). This instrument will be used for routine surveys associated with operational aspects of decommissioning activities such as monitoring personnel and equipment exiting a radiologically controlled area.

4.8.4 Excavated Soil Scan Instrumentation

Excavated soil gamma surveys will be performed using a Ludlum Model 4612. The Ludlum Model 4612 features a single-channel analyzer assembly array equipped with a programmable computer that streamlines all necessary operating parameters. Up to 12 detector assemblies can be used with the instrument, each with independent high-voltage, threshold, and window parameter settings. Parameters are loaded from a built-in flash memory that initiates during the power-up sequence. The parameters also include settings for upper and lower level discriminator, count time, count time range, output time, and recycle mode or slave mode settings. When connected to a NaI detector, the instrument is capable of detecting gamma photon energies ranging from 60 kilo-electron volts (keV) to 3 mega-electron volts (MeV). The instrument will be programmed to respond to the full spectrum of gamma photon energies.

Four arrays of three Ludlum Model 44-10 2-inch by 2-inch NaI detectors, spaced 12 inches apart, will be connected to a Ludlum Model 4612 instrument and a Global Positioning System (GPS) that will be used to plot and correlate logged data points to specific coordinates. The detectors will be positioned so that each will be maintained a distance of 4 inches from the surface being surveyed. The instrument array will be positioned on the back of a tow vehicle so as to "follow behind" the path of the vehicle. Survey lanes will be spaced 12 inches apart.

4.8.5 Instrument for Exposure Rate Surveys

Exposure rate surveys are conducted with use of a Ludlum Model 19 MicroR meter (or equivalent). Compatible with anticipated exposure rates, the instrument is equipped with an internally mounted 1-inch by 1-inch NaI scintillation detector that is integral to the meter housing.

4.9 ON-SITE RADIOLOGICAL LABORATORY INSTRUMENTATION

On-site laboratory equipment will be used to analyze most radiological samples collected in the field. Table 4-2 lists the types of measurements and laboratory equipment to be used on site during survey activities for the sanitary sewer and storm drain removal action. Chemical analyses of selected alpha, beta, and gamma analyses for QC purposes will be analyzed at off-site laboratories in accordance with the SAP (Appendix A).

4.9.1 Quality Assurance Checks

QA checks shall be performed on laboratory instrumentation to ensure proper operation and to maintain calibration. The quality checks shall be documented, reviewed, and maintained. Data trends outside the tolerance limits shall be investigated to determine the cause and potential effect on measurement results.

4.9.2 Gross Alpha and Beta/Gamma Removable Surface Contamination Surveys

Swipe samples will be processed using a Protean IPC 9025 gas-flow proportional alpha and beta/gamma radiation counter (or equivalent), which features a low-background counting chamber. A microprocessor allows for data processing, and the unit provides a full range of simultaneous alpha and beta/gamma analysis at levels required for environmental release surveillance. Data is reported in units of disintegrations per minute (dpm) per 100 square centimeters (cm^2).

4.9.3 Gamma Spectroscopy

Gamma spectroscopy analysis is performed using hardware features that include a high-purity Germanium gamma photon detector supported by software. Instrument hardware is calibrated using a multi-energy National Institute of Standards and Technology (NIST)-traceable source ranging from 10 keV to 2 MeV. Data results will be reviewed for QA and reported in units of picocurie per gram (pCi/g). Analysis and review processes will address count integration, efficiency, and background corrections, as well as the processing of overlapping peaks. Gamma spectroscopy focuses on energetic photons emitted from ROCs. A spectral region of interest results around a specified energy range allows for identification and quantification of associated nuclides and daughter products.

4.9.4 Strontium-90 Analysis

A minimum of 10 percent of samples are randomly chosen for ^{90}Sr analysis at the on-site laboratory. An approved procedure describes a method for separation and superscript measurement of ^{90}Sr in various media through the use of a specialized cation resin. The extraction system in the proprietary specialized resin is 1.0 molar 4,4'(5')-di-*t*-butylcyclohexano 18-crown-6 (crown ether) in 1-octanol. A 40 percent loading of this organic solution is loaded onto an inert chromatographic support. The bed density of strontium resin is approximately 0.35 grams per milliliter. The radioactive ^{90}Sr is separated using the specialized resin prior to gas proportional counting. Small amounts of ^{90}Sr tracer are used to monitor method yields and correct results to improve precision and accuracy.

4.9.5 Alpha Spectroscopy

Alpha-emitting radioisotopes spontaneously produce alpha particles (or helium-4 nuclei) at characteristic energies usually between about 3 and 6 MeV. Alpha particles are heavily charged particles. Because they are large and slow, alpha particles readily lose energy in materials. Any physical medium between the alpha-emitting radionuclide and the active portion of the detector will absorb some of the alpha particle energy.

The alpha particle energies of many isotopes differ by as little as 10 to 20 keV. Because this is near the resolution of the silicon detectors used in alpha spectrometers, such elements must be chemically separated before analysis. This chemical separation is intended to isolate specific elements in the sample to minimize interferences between multiple alpha-emitting nuclides. In order to account for the inevitable loss of the sample during separation, a known quantity of a specific isotope or tracer is added to the sample. These NIST-traceable tracers are isotopes of one of the elements under study; i.e., uranium-232 for uranium quantification. Since all isotopes of an element behave chemically alike: the percent of tracer lost in the chemical processes is equal to the percent of sample lost, assuming the tracer is homogeneously mixed with the sample and is brought into chemical equilibrium with the sample.

In order to obtain the thinnest sample possible, thereby minimizing self attenuation, samples must be properly mounted. After the sample is placed into the chamber and the chamber evacuated, data are acquired from the sample for a preset period of time. Because of the low activities involved, acquisitions are often very long to achieve the desired minimum detectable activity (MDA). After data is acquired, analysis software processes the spectrum and quantifies the results for the isotopes of interest. Analysis can consist of simple count integration and efficiency correction and may also involve extensive background corrections, compensation for various chemical process characteristics, processing of overlapping peaks, etc. Analysis will be performed by chemical separation using subcontractor approved SOPs. An EG&G Ortec® Octête Alpha Spectroscopy system, combined with Alpha-Vision® software will be used. The results of alpha spectroscopy analysis are reported in pCi/g, picocurie per milliliter (pCi/mL), or picocurie per liter pCi/L, depending on the media analyzed.

4.10 INSTRUMENT EQUATIONS

The following equations are used to calculate efficiencies, minimum detectable concentrations (MDCs) and minimum detectable count rates (MDCRs). These equations are presented in the Base-wide Plan, Rev. 1 (TtEC, 2007) developed for HPS. The Base-wide Plan, Rev. 1 presents a standardized *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM)-compliant approach (DoD et al., 2000) for radiological surveys and remediation.

4.10.1 Instrument Efficiency

The instrument efficiency (ε_i) is defined as the ratio between the net count rate, in counts per minute (cpm), of the instrument and the surface emission rate of the calibration source for a specified geometry. The surface emission rate is the 2π particle fluence affected by both the attenuation and backscatter of the radiation emitted from the calibration source.

Equation 7-1 from the Base-wide Plan, Rev. 1 (TtEC, 2007) will be used to calculate the instrument efficiency in counts per particle; although efficiency is typically reported as having no units or being unitless.

Equation 7-1 from the Base-wide Plan, Rev. 1

$$\varepsilon_i = \frac{R_{S+B} - R_B}{q_{2\pi}\left(\frac{W_A}{S_A}\right)}$$

Where:

ε_i = instrument efficiency (count per particle)
R_{S+B} = the gross count rate of the calibration measurement (cpm)
R_B = the background count rate in cpm
$q_{2\pi}$ = surface emission rate of the calibration source (NIST-traceable) (particles per minute [min])
W_A = active area of the detector window (cm^2)
S_A = area of the source (cm^2)

The instrument efficiency is determined by obtaining static counts with the detector over a calibration source that has a NIST-traceable surface emission rate. The 2π particle fluence rate is corrected for decay, attenuation, and scatter. Then the surface emission rate of the source must be corrected for the area subtended by the probe. Factors that can also affect the instrument's efficiency are discussed below:

- Efficiency Check Sources. Efficiency check sources that emit alpha or beta radiation with energies similar to those expected from the contaminant in the field (similar to the expected ROCs) will be selected.
- Source Geometry Factors. Instrument efficiency will usually be determined with an efficiency check source equal to or greater than the area of the probe. If a source that is smaller than the probe is used, a conversion factor is applied to the MDC to account for the active region of the probe.
- Source-to-detector Distance. The detector efficiency will be calculated at a source-to-detector distance the same as the detector-to-surface distance used in the field.

4.10.2 Minimum Detectable Concentration for Static Alpha and Beta Counts

The static MDC is the level of radioactivity practically achievable by the overall measurement process. The conventional equation, Equation 7-7 from the Base-wide Plan, Rev. 1 (TtEC, 2007), shown below is used to calculate instrument MDC in units of dpm per 100 cm^2:

Equation 7-7 from the Base-wide Plan, Rev. 1

$$MDC = \frac{3 + 4.65\sqrt{R_B T_B}}{\varepsilon_s \varepsilon_i \frac{W_A}{100} T_B}$$

Where:

3+4.65	=	constant factor provided in MARSSIM
R_B	=	background count rate (cpm)
T_B	=	background counting time (min)
ε_i	=	instrument efficiency (count per particle)
ε_s	=	contaminated surface efficiency (particle per disintegration)
W_A	=	active area of the detector window (cm^2)

In Equation 7-7 from the Base-wide Plan, Rev. 1 (TtEC, 2007), W_A is the size of the "active" area of the detector window. If the area of the detector window (cm^2) does not equal 100 cm^2, it is necessary to convert the detector response to units of dpm per 100 cm^2.

If the background and sample are counted for different time intervals, Equation 7-8 from the Base-wide Plan, Rev. 1 (TtEC, 2007) is used to calculate the MDC in dpm per 100 cm^2.

Equation 7-8 from the Base-wide Plan, Rev. 1

$$MDC = \frac{3 + 3.29\sqrt{R_B T_{S+B}\left(1 + \frac{T_{S+B}}{T_B}\right)}}{\varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2} T_{S+B}}$$

Where:

3+3.29	=	constant factor provided in MARSSIM
R_B	=	background count rate (cpm)
T_B	=	background counting time (min)
T_{S+B}	=	sample counting time (min)
ε_i	=	instrument efficiency (count per particle)
ε_s	=	contaminated surface efficiency (particle per disintegration)
W_A	=	active area of the detector window (cm^2)

4.10.3 Surface Efficiency (ε_s) for Surface Activity Measurements

The surface efficiency term in the preceding equations is used to determine the 4π total efficiency for a particular surface and condition. Suitable values are based on the radiation and radiation energy, and are primarily impacted by the backscatter and self-absorption characteristics of the surface on which the contamination exists in the field. Backscatter is most affected by the energy of the radiation and the density of the surface material. Self-absorption characteristics or attenuation are also a function of the radiation's energy and surface condition. In the absence of experimentally determined surface efficiencies, ISO-7503-1 (International Organization for Standardization [ISO], 1988) and NUREG-1507 (NRC, 1997), provide conservative recommendations for surface efficiencies. ISO-7503-1 recommends a surface efficiency of 0.5 for maximum beta energies exceeding 0.5 MeV and to use a surface efficiency of 0.25 for beta energies between 0.15 and 0.4 MeV and for alpha emitters (ISO, 1988; NRC, 1997). NUREG-1507 provides surface efficiencies based on studies performed for the NRC. In general, NUREG-1507 indicates that the ISO rule-of-thumb for surface efficiencies is conservative, particularly for beta-emitting radionuclides with end-point energies between 0.25 MeV and 0.4 MeV. At HPS, a surface efficiency of 0.25 will be used for alpha and beta emitters.

4.10.4 Minimum Detectable Count Rate and Minimum Detectable Concentration for Beta and Gamma Scans

The minimum detectable number of net source counts in the scan interval can be arrived at by multiplying the square root of the number of background counts (in the scan interval) by the detectability value associated with the desired performance (as reflected in d') as shown in Equation 7-5 from the Base-wide Plan, Rev. 1 (TtEC, 2007).

Equation 7-5 from the Base-wide Plan, Rev. 1

$$MDCR = d'\sqrt{b_i}\left(\frac{60}{i}\right)$$

Where:

d' = index of sensitivity (alpha [α] and beta [β] errors [performance criteria])
b_i = number of background counts in scan time interval (count)
i = scan or observation interval (s)

The required rate of true positives will be 95 percent, and the false positives will be 60 percent. From Table 6.5 of MARSSIM (DoD et al., 2000), the value of d', representing this performance goal, is 1.38.

The scan MDC is determined from the MDCR by applying conversion factors that account for detector and surface characteristics and surveyor efficiency. As discussed below, the MDCR accounts for the background level, performance criteria (d'), and observation interval. The observation interval during scanning is the actual time that the detector can respond to the contamination source. This interval depends on the scan speed, detector size in the direction of the scan, and area of elevated activity.

The scan MDC for beta surveys of structure surfaces is calculated using Equation 7-6 from the Base-wide Plan, Rev. 1 (TtEC, 2007).

Equation 7-6 from the Base-wide Plan, Rev. 1

$$Scan\ MDC = \frac{MDCR}{\sqrt{p}\ \varepsilon_i \varepsilon_s \frac{W_A}{100\ cm^2}}$$

Where:

$MDCR$ is discussed above
p = surveyor efficiency factor
ε_i = instrument efficiency (count per particle)
ε_s = contaminated surface efficiency (particle per disintegration)
W_A = area of the detector window (cm^2)

4.10.5 MDC for Gamma Scans of Surface Areas (2-inch by 2-inch NaI Probe)

The scan MDC (in pCi/g) for land areas is based on the area of elevated activity, depth of contamination, and the radionuclide (energy and yield of gamma emissions.) To establish the scan MDC, the relationship between the detector's net count rate to net exposure rate must be established first. This is accomplished by determining the MDCR and then applying a surveyor efficiency factor. The MDCR is calculated using 7-5 from the Base-wide Plan, Rev. 1 (TtEC, 2007) with the following variables:

d' = 1.38 (from Table 6.5 in MARSSIM)
b_i = 5,510 cpm / (60 seconds per minute/6-second observation) = 551 counts per second
i = 6 seconds

Therefore, MDCR equals 324 cpm.

To get the $MDCR_{Surveyor}$, a surveyor efficiency factor p is applied as shown below in Equation 7-9 from the Base-wide Plan, Rev. 1 (TtEC, 2007):

Equation 7-9 from the Base-wide Plan, Rev. 1

$$MDCR_{Surveyor} = MDCR \big/ \sqrt{p}$$

The $MDCR_{Surveyor}$ can then be calculated assuming a surveyor efficiency (p) of 0.7 and the estimated background count rate of 5,510 cpm (taken from a non-impacted area in Parcel E) and assuming a 6-second scan observation interval as follows:

$$MDCR_{Surveyor} = \frac{MDCR}{\sqrt{p}} = \frac{324}{\sqrt{0.7}} = 387\,cpm$$

The $MDCR_{Surveyor}$ is then converted into the corresponding minimum detectable exposure rate (MDER) by use of a calibration constant specific to the detector being used and the ROC. For example, when used with the Ludlum Model 2350-1, the calibration records for the Ludlum Model 44-10 2-inch by 2-inch NaI scintillation detector provide a calibration constant that can be used to determine the ratio of cpm to microroentgen per hour (μR/hr). As shown in Equation 7-10 from the Base-wide Plan, Rev. 1 (TtEC, 2007), a dose rate can be calculated for a given count rate and vice versa.

Equation 7-10 from the Base-wide Plan, Rev. 1

$$MDER\,(\mu R/hr) = \frac{MDCR_{Surveyor} * 6 \times 10^{7}}{cc}$$

Where:

$MDCR_{Surveyor}$ = 387 cpm (calculated in Equation 7-9)

cc = calibration constant = 5.4×10^{10} counts/R (average)

6×10^{7} = a conversion factor accounting for differences in time and activity units (microRoentgen per minute [μR-min]/Roentgen per hour [R-hr])

$MDER$ = 0.43 μR/hr

Next, the relationship between the radionuclide concentration and exposure rate is established. This is accomplished by modeling (using MicroShield™ software [Grove Engineering, 1996]) to determine the net exposure rate produced by the radionuclide at a distance above ground. The factors considered in modeling include:

- The dose point of 10 centimeters (cm) (4 inches) above the soil
- The density of material in grams per cubic centimeter (g/cm^3)
- Derived concentration guideline level (DCGL) of the ROC in pCi/g
- The depth of detection for the DCGL
- The circular dimension of the cylindrical area of detector capability (square meters [m^2])

The concentration of the ROC (Scan MDC) necessary to yield the MDER may be calculated by taking the ratio of the MDER to the exposure rate calculated by MicroShield (Grove Engineering, 1996) as shown in Equation 7-10 from the Base-wide Plan, Rev. 1 (TtEC, 2007), using the following input parameters:

- The dose point of 4 inches above the soil was used.
- The density of 1.6 g/cm^3 was used for soil.
- The ^{226}Ra concentration of 1.0 pCi/g was used.
- The depth of the area of elevated activity was 15 cm.
- The circular dimension of the cylindrical area of elevated activity was 0.25 m^2.

MicroShield Version 5.05 (Grove Engineering, 1996) calculates the exposure rate to be 0.7384 μR/hr for ^{226}Ra (which accounts for buildup). The radionuclide concentration of ^{226}Ra (scan MDC) necessary to yield the MDER calculated in Equation 7-10 (0.43 μR/hr) may be calculated by taking the ratio of the MDER to the exposure rate calculated by MicroShield, as shown in Equation 7-11 from the Base-wide Plan, Rev. 1 (TtEC, 2007).

Equation 7-11 from the Base-wide Plan, Rev. 1

$$Scan\ MDC(pCi/g) = \frac{DCGL\ pCi/g * MDER\,\mu R/hr}{Microshield\ Exposure\ Rate\,\mu R/hr} = 0.58\ pCi/g$$

Where:

DCGL = 1.0 pCi/g (from Table 3-1)

MDER = 0.43 μR/hr (from Equation 7-10 from the Base-wide Plan, Rev. 1)

MicroShield Exposure Rate = 0.7384 μR/hr

Microshield Version 5.05 calculates the exposure rate to be 0.0295 μR/hr for ^{137}Cs (which accounts for buildup). The radionuclide concentration of ^{137}Cs (scan MDC) necessary to yield the MDER calculated in Equation 7-10 (0.43 μR/hr) may be calculated by taking the ratio of the MDER to the exposure rate calculated by Microshield, as shown in Equation 7-11 from the Base-wide Plan, Rev. 1 (TtEC, 2007).

Equation 7-11 from the Base-wide Plan, Rev. 1

$$Scan\ MDC(pCi/g) = \frac{DCGL\ pCi/g * MDER\,\mu R/hr}{Microshield\ Exposure\ Rate\,\mu R/hr} = 1.647\ pCi/g$$

Where:

DCGL = 0.113 pCi/g (from Table 3-1)

MDER = 0.43 μR/hr (from Equation 7-10 from the Base-wide Plan, Rev. 1)

Microshield Exposure Rate = 0.0295 μR/hr

4.10.6 MDC for Static Gamma Measurements

For gamma surveys, MDC is calculated in cpm. Equation 7-12 from the Base-wide Plan, Rev. 1 is used to calculate the MDC.

Equation 7-12 from the Base-wide Plan, Rev. 1

$$MDC = \frac{3 + 4.65\sqrt{R_B T_B}}{T_B}$$

Where:

3+4.65	=	constant factor provided in MARSSIM
R_B	=	background count rate (cpm)
T_B	=	background counting time (minute [min])

The inputs observed in the reference area will be used in Equation 7-12 to calculate the MDC for the Ludlum Model 2350-1 for ^{226}Ra and ^{137}Cs.

4.11 SURVEY IMPLEMENTATION

Radiological control procedures will be implemented to support remediation activities for the sanitary sewer and storm drain systems. These procedures are intended to protect the health and safety of project personnel and the general public, to comply with the subcontractor's NRC license requirements under which the work is to be performed, and to comply with ALARA principles. The following subsections describe the survey procedures that will be performed during implementation of this Work Plan.

4.11.1 Reference (Background) Areas

An average background level will be determined by performing a minimum of 18 measurements at systematic or random locations within a designated background area. The detector probe will be held approximately 10 cm (4 inches) from the surface area for gamma and 0.6 cm (0.25 inch) from the surface area for alpha/beta radiation. Instrumentation will be allowed to stabilize before background readings are taken. The average of the readings taken will determine the background for each energy emission. Background exposure rates will also be collected for reference data. Some solid samples will need to be collected in the background area for comparative analyses of post-excavation sample analyses. The same survey methodology and instruments used to collect the background data will be used to perform measurements within survey units.

Data collected in reference areas will be statistically evaluated using a graphical format, such as a frequency distribution chart. The purpose of the evaluation is to ensure that the data collected in the reference area are consistent with a normal distribution and that the variability of the background is not too high.

4.11.2 Scan Surveys

Scan surveys are an evaluation technique performed by moving a detection device over a surface at a specified speed and distance above the surface to detect radiation. The device will be used to identify areas that may require additional survey measurements.

Excavated soil scan surveys for gamma radiation will be performed using the towed array described in Section 4.8.4.

4.11.2.1 Scan Surveys for Alpha/Beta Radiation

Surface scan surveys for alpha and beta radiation will be performed by moving the detector over the surface being surveyed at a rate of approximately 2.5 cm (1 inch) per second. The detector will be held approximately 0.6 cm (0.25 inch) above the surface being surveyed.

4.11.2.2 Scan Surveys for Gamma Radiation

Surface scan surveys for gamma radiation will be performed by traversing a path at a maximum speed (scan rate) of approximately 0.08 meter per second, while maintaining the detector approximately 10 cm (4 inches) above the area being surveyed.

4.11.3 Static Surveys

Static surveys are used to determine contamination levels on surface areas. The surveys are an evaluation technique performed by holding a detection device over a surface for a specified time at a set distance to detect radiation.

4.11.3.1 Static Surveys for Alpha/Beta Radiation

Static alpha/beta measurements will be conducted with the detector approximately 0.6 cm (0.25 inch) above the surface. Count time for conducting the measurement is dependent upon the isotope of concern. When the alpha/beta static measurements are used to release equipment and materials, a 1-minute count time will be sufficient to measure the appropriate release criteria.

Materials that will be surveyed for alpha and beta contamination will be done so as to determine the disposition of the material. In such cases, the AEC's *Regulatory Guide 1.86* limits (identified in Table 4-3) will be used.

4.11.3.2 Static Surveys for Gamma Radiation

Static gamma measurements require positioning the detector assembly approximately 10 cm (4 inches) above the surface and completing a stationary 60-second survey.

4.11.4 Exposure Rate Measurements

Exposure rate surveys are performed to measure ambient gamma radiation levels. Exposure rate measurements are obtained by holding the detection device approximately 1 meter from the surface being surveyed. Instrumentation will be allowed to stabilize for approximately 30 seconds before taking the measurement.

4.11.5 Swipe Sample Measurements

Swipe sampling will be performed to assess the presence of radioactive contamination readily removed from a surface. Swipe samples will be taken to evaluate the presence of alpha and beta/gamma surface activity.

4.11.6 Equipment and Material Surveys

Equipment and material surveys will be performed following the methods in Sections 4.11.2, 4.11.3, and 4.11.5. Table 4-3 provides acceptable levels of contamination based on the AEC *Regulatory Guide 1.86* limits (1974). In the event that survey results indicate that levels of contamination exceed the limits listed in Table 4-3, appropriate decontamination methods may be performed to minimize waste. If decontamination methods are unsuccessful, the material will be disposed of as radioactive waste.

Before being put into service or leaving a radiological work area, equipment and/or materials will be surveyed in an area of low-background concentrations to ensure that the equipment and materials release criteria are not exceeded.

- New equipment and/or materials being put into service in a radiological work area at HPS that exceed the release criteria will be returned to the supplier for replacement or decontamination.
- Equipment and/or materials that do not meet the release criteria will be decontaminated before leaving the radiological work area or stored for disposal.

4.11.7 Personnel Surveys

Properly trained staff will perform personnel surveys in a pre-designated low-background area, before leaving a radiologically controlled area as specified in the RWP or when deemed necessary by the RCT. Personnel not qualified to administer a self-survey will be monitored by a qualified technician.

4.11.8 Media Sampling

Various samples may be collected for radiological analysis, including soil, sediment, and water. Appendix A, the SAP, describes the methods for collecting samples, sample numbering, sample labeling, sample shipment, and completion of the associated chain-of-custody and other required documentation. Media samples for gamma spectroscopy and removable surface contamination will be analyzed on site using instrumentation described in Sections 4.9.2 and 4.9.3. Samples for alpha and beta analysis will be analyzed at the on-site laboratory. In addition, 10 percent of the media samples analyzed by the on-site laboratory for gamma spectroscopy will also be analyzed at an off-site laboratory, as described in Appendix A.

4.11.9 Air Sampling

As specified in the RWP, airborne activity monitoring (continuous or grab samples) will be used during the course of work. In order to control occupational exposures, establish PPE, and determine respiratory protection requirements, monitoring and trending for airborne radioactive material will be performed as necessary. Engineered controls, with concurrence from the RASO, will be implemented if required to maintain airborne concentrations below 10 percent of the applicable derived airborne concentration (DAC) value for the ROCs (Table 4-4). At a minimum, air sampling for radionuclides will be performed upwind, downwind, and at the excavation location.

If, during the course of work, an airborne concentration exceeds 10 percent of the DAC, ongoing activities will cease and the affected location will be posted until the source of the airborne concentration is eliminated and levels are confirmed to be below 10 percent of the DAC.

4.12 SAMPLING PROTOCOL

In support of this Work Plan, numerous soil samples will be collected to determine their radionuclide concentrations. Direct surface radiation measurements will be performed at each location before initiating sampling to identify any presence of gross contamination. If elevated radiation levels are present, samples and equipment will be treated as radioactive and handled accordingly. Appendix A of this document provides a more detailed discussion of the sampling and analysis procedures for the scope of this work. Section 7.0 also discusses the various types and quantities of samples that will be collected during the performance of this work.

4.13 POST-WORK AREA SURVEILLANCE

At the conclusion of each workday, the assigned RCT(s) will complete necessary paperwork associated with the daily radiological surveys. Air samples will be collected and analyzed to ensure that exposure to radioactive particulates is maintained below the designated levels.

4.14 DECONTAMINATION PROCEDURES

TtEC SOPs will be used to decontaminate equipment and materials. Equipment or materials that cannot be easily or cost-effectively decontaminated will be evaluated for possible limited use in radioactive material use areas, or disposed of as radioactive waste. Decontamination water will be collected and sampled before it is disposed of properly.

5.0 FINAL STATUS SURVEYS

The MARSSIM (DoD et al., 2000), the *Nonparametric Statistical Methodology for the Design and Analysis of the Final Status Decommissioning Survey Guide* (NUREG-1505; NRC, 1998), and the *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions Guide* (NRC, 1997, 1998) were used as guidance in designing the FSSs.

5.1 OBJECTIVE OF THE FINAL STATUS SURVEY

MARSSIM (DoD et al., 2000), NUREG-1505 (NRC, 1998), and NUREG-1507 (NRC, 1997) were used as guidance documents in the design of this Work Plan. The objective of the FSS is to demonstrate that identified residual radioactivity levels inside the excavated trench and excavated soils to be used as backfill meet the release criterion. In demonstrating that this objective is met, the null hypothesis (H_o) is tested for residual contamination that exceeds the release criterion; the alternative hypothesis (H_a) is then tested for residual contamination that meets the release criterion.

5.2 SURVEY GRIDS

A reference coordinate system will be laid out for each survey unit. A triangular grid system will be used for the excavated soil and the trenches. The length, L, of a side of the square grid is determined by the total number of samples or measurements to be taken. The length of the square will determine the distance between survey data points. The length or sample spacing of the grids will be calculated for each of the survey units using the following equation:

Equation 4-2 from the Base-wide Plan, Rev. 1

$$L = \sqrt{\frac{A}{0.866 * N}}$$

Where:

L	=	length of sample spacing (meters [m])
A	=	surface area of the survey unit (m^2)
0.866	=	*constant factor from MARSSIM*
N	=	statistically calculated number of samples

5.3 SURVEY UNITS

Initial surveys will consist of two different types of survey units: trench units and excavated soil (ES) units. The combination of the trench unit and the associated ES unit(s) used for backfill will compose a single survey unit. Each ES unit and trench unit must stand up to individual scrutiny as a single survey unit. The concentrations of radioactive material in each of the survey units are not expected to vary significantly from one survey unit to the other. Although the size of each survey unit may vary, each will receive the same survey and sampling frequency coverage.

5.3.1 Trench Survey Units

Trench survey units will encompass an excavated trench section not to exceed 1,000 m^2 in surface area or 500 linear feet, whichever is most restrictive. Each excavated trench survey unit will undergo a 100 percent scan survey for gamma radiation. A minimum of 18 discrete surveillance points will be spaced using the triangular grid pattern in Equation 4-2, using the most current version of Visual Sampling Plan (VSP) software.

5.3.2 Excavated Soil Survey Units

ES survey units will be comprised of up to 1,000 m^2 of surface area or 100 linear feet of excavated trench soils spread out in lifts not to exceed 6 inches in height. Each ES survey unit will undergo a 100 percent scan survey for gamma radiation. A minimum of 18 discrete surveillance points will be spaced using the triangular grid pattern in Equation 4-2 from the Base-wide Plan, Rev. 1, using the most current version of VSP software.

5.4 SURVEY UNIT CLASSIFICATION

The classification of areas for the FSS is a critical step in the survey design process so that each site area receives adequate survey coverage. The working hypothesis of MARSSIM (DoD et al., 2000) is that all impacted areas being evaluated for release have a potential for radioactive contamination above the DCGL. This initial assumption means that all areas are initially considered Class 1 areas, unless some basis for reclassification as non-impacted, Class 3, or Class 2 is provided. Class 1 areas have the greatest potential for contamination, and therefore receive the highest degree of survey effort, followed by Class 2 and then Class 3 areas.

The survey units will be limited in size based on classification and site-specific conditions. MARSSIM (DoD et al., 2000) recommends areas for survey units according to the following:

Classification	Suggested Area
Class 1 Land Areas	up to 2,000 m^2

The limitation on survey unit size ensures that each area is assigned an adequate number of data points.

5.5 DATA QUALITY OBJECTIVES

The DQO process is a series of planning steps for establishing criteria for data quality and survey design development. The level of planning is based on the complexity of the areas to be surveyed.

5.5.1 State the Problem

It must be determined if the site-specific release guideline has been met or if remediation is warranted. Therefore, the decision to be made can be stated as, "Do the survey results meet the soil RROs for the radionuclides of concern?"

It is anticipated that successful completion of activities described in this survey plan will provide sufficient data for the unrestricted release of the sanitary sewer and storm drain trenches and ES. Resources available to provide the necessary data include the following:

- Activities outlined in this Work Plan
- MARSSIM guidance (DoD et al., 2000) for ensuring statistically valid data
- The use of trained and experienced workers

5.5.2 Identify the Decision

The need to provide data for the unrestricted release of the sanitary sewer and storm drain trenches and ES requires performing radiological surveys and sampling as specified in this Work Plan.

The primary uses of the data expected to result from completion of this Work Plan is to provide information and statistical verification of data obtained to support the unrestricted release of the sanitary sewer and storm drain trenches and ES.

5.5.3 Inputs to the Decision

Radiological surveys required supporting the unrestricted release of the sanitary sewer and storm drain trenches and ES will include:

- One hundred percent gamma scan surveys of each of the survey units with 2-inch by 2-inch NaI detectors or equivalent. Results less than background plus 3 sigma levels are considered acceptable.
- Systematic soil sampling of the Class 1 survey units. Results below the release criteria for soil contamination are considered acceptable.
- Statistical analysis of collected radiological data.

5.5.4 Definition of Study Boundaries

The spatial boundaries for this FSS effort are confined to the radiologically impacted sanitary sewer and storm drain systems. Each survey unit will be 100 percent, gamma scan surveyed. Solid samples will be collected from systematic locations in each of the survey units.

5.5.5 Development of a Decision Rule

5.5.5.1 Release Limits

The release limits (RROs) for this survey are listed in Table 3-1.

5.5.5.2 Alternative Actions

Readings greater than 3 sigma that of background or sample results that exceed the release limits will be further investigated to identify the extent of the contamination.

5.5.6 Limits on Decision Errors

Actions to minimize errors will be instituted during the data collection phase of the radiological survey. Qualified radiation survey personnel will perform the survey and record the data. Automated recording of survey data will be used where possible to minimize errors. Data transcribing is the second phase where errors may arise. To avoid data errors for manual surveys, experienced personnel will record and transcribe data.

The ongoing on-site analyses and evaluation of survey results provides a final check for errors, which if detected, can be corrected.

A knowledgeable individual who is not involved in the direct data collection process (Radiation Task Supervisor) will review the survey data on a daily basis. This will ensure an ongoing independent review for consistency of all survey data collected.

There are two types of decision errors that can be made when performing the statistical tests described in this plan. The first type of decision error, called a Type I error, occurs when the null hypothesis is rejected when it is actually true. A Type I error is sometimes called a "false positive." The probability of a Type I error is usually denoted by α. The Type I error rate is often referred to as the significance level or size of the test.

The second type of decision error, called a Type II error, occurs when the null hypothesis is not rejected when it is actually false. A Type II error is sometimes called a "false negative." The probability of a Type II error is usually denoted by β . The *power* of a statistical test is defined as the probability of rejecting the null hypotheses when it is false. It is numerically equal to $1-\beta$, where β is the Type II error rate.

This survey is designed to limit Type I and Type II errors to 5 percent. It is important to minimize the chances that area grids exceeding the release limits will be missed (Type I Error) and area grids meeting the release limits will be rejected as too high (Type II Error). The probability of either of these occurring will be set at a maximum of 5 percent. However, in the event that double sampling is used, the Type I error will be set at a maximum of 2.5 percent, as discussed in Section 5.5.6.1.

In demonstrating that this objective is met, the null hypothesis (H_o) is tested that residual contamination exceeds the release criterion; the alternative hypothesis (H_a) is then tested that residual contamination meets the release criterion.

5.5.6.1 Double Sampling

When determined to be appropriate, and when the retrospective power of the test using the first set of samples does not meet the design objectives, double sampling may be employed with the concurrence of the RSM. Double sampling will be avoided by proper survey design, and only used when determined to be absolutely necessary. The procedure is discussed in Appendix C of NUREG-1757 Volume 2 (DoD et al., 2000).

From Appendix C, "Such allowance [for double sampling] should be specifically mentioned in preparing the DQOs and in advance of any sampling and analysis. During the DQO process, double sampling could be considered as an option when setting the Type I error rates." Later in the Appendix, "…double sampling should not be used as a substitute for adequate planning. If it is to be allowed, this should be agreed upon with NRC staff [DTSC and EPA for HPS] as part of the DQO process. The procedure for double sampling, i.e., the size of the second set of samples, N_2, should be specified, recognizing that the Type I error rate could be up to twice that specified for the Sign test when only one set of samples is taken." Further, "Similar considerations apply for the WRS test; however, the calculation of the exact effect on the Type I error rate is considerably more complex."

The difference between the number of samples collected and the amount of samples required (when using the updated Type I error rate in calculations) will be doubled, and these additional samples will be collected randomly and added to initial sample data. The Type I error rate for such events will be revised and limited to a maximum of 2.5 percent.

5.5.7 Optimizing Data Collection

5.5.7.1 Review Outputs and Existing Data for Consistency

Radioactive source readings will be used to check instruments for consistency prior to use in each daily shift. The instrument will only be used after readings are compared and agree within +/- 20 percent of predetermined responses. The on-site Radiation Task Supervisor will review the information each day to verify that equipment is operating satisfactorily.

A knowledgeable individual not involved in the direct data collection process will review the survey data on a daily basis. This will ensure an ongoing independent review for consistency of all survey data collected.

5.5.7.2 Develop Data Collection Design Alternatives

The MARSSIM guidelines (DoD et al., 2000) will be used and a 95 percent confidence level for detecting radioactivity above the release levels will be assumed with Type I and Type II errors limited to 5 percent.

5.5.7.3 Data Collection Design Alternatives

The data collection design alternatives may change slightly if assumptions are revised based on conditions in the field being different than the furnished information derived from historical research and current knowledge of the building.

5.5.7.4 Select Most Resource-effective Survey Design

As indicated above, the survey design specified for use in this Work Plan was developed to perform radiological FSSs. Combined with the use of qualified and experienced personnel, this design is considered as both efficient and resource effective.

5.5.7.5 Document Operational Details and Theoretical Assumptions

Operational details for the radiological survey process have been developed for and are included as part of this Work Plan. The theoretical assumptions are based on guidelines contained in MARSSIM (DoD et al., 2000). Specific assumptions regarding types of radiation measurements, instrument detection capabilities, quantities and locations of data to be collected, and investigation levels are contained in this Work Plan.

5.6 STATISTICAL TESTS

Regulatory guidance, as identified in MARSSIM (DoD et al., 2000), recommends use of the sign test to conservatively evaluate surveillance results that will be obtained from this survey.

5.6.1 Determining the Numbers of Data Points for the WRS Test

Since the ROCs are present in background, N is calculated in the manner specified for the Wilcoxon Rank Sum test (Equation 5-2, Base-wide Plan, Rev. 1, TtEC, 2007).

Equation 5-2 from the Base-wide Plan, Rev. 1

$$N = \frac{\left(Z_{1-\alpha} + Z_{1-\beta}\right)^2}{3\left(P_r - 0.5\right)^2}(1.2)$$

Where:

$Z_{1-\alpha}$ = 1.645 Type I decision error level (or 1.960 if double sampling is used)
$Z_{1-\beta}$ = 1.645 Type II decision level
P_r = 0.997658 random measurement probability (from Table 5.1 in MARSSIM [NUREG-1575, DoD et al., 2000])
(1.2) = 20 percent increase in number of samples over the minimum

Variable used to calculate N not already specified in the Base-wide Plan (Tetra Tech FW, Inc. [TtFW], 2005) is the random measurement probability P_r. P_r in Equation 5-1 from the Base-wide Plan above is based on the relative shift. The relative shift is equal to Δ/σ, where Δ is equal to DCGL-lower boundary of the gray region (LBGR) and σ is an estimate of the standard deviation of the measured values in a survey unit. The LBGR is the net median concentration of the contaminant in the survey unit. When this value is unknown, MARSSIM (NUREG-1575, DoD et al., 2000) suggests using a value for the LBGR of half the DCGL, which was used. Likewise, σ was assigned the value of the standard deviation of the measurement values in the reference area.

The values used for these parameters to determine a P_r were 332 cpm (half of the DCGL) for Δ and 74.2 cpm for σ. The value for Δ was derived by converting the DCGL from pCi/g to cpm and dividing by 2. To perform this conversion, an arbitrary concentration of ^{226}Ra is divided by the associated exposure rate produced by this concentration of ^{226}Ra (as identified in Section 4.10.5). The resulting number is then divided by the average net cpm per μR/hr for the detectors on the towed array. Once this number is derived, the release criteria of 1.0 pCi/g for ^{226}Ra is divided by this number, as shown in Equation 6-9 (Base-wide Plan, Rev. 1, TtEC, 2007) below:

Equation 6-9 from the Base-wide Plan, Rev. 1

$$665 = \frac{1.0}{1/0.7384 * 1/900}$$

Where:

1.0 = release criteria (pCi/g)
1 = arbitrary concentration of ^{226}Ra (pCi/g)
0.7384 = exposure rate for 1 pCi/g ^{226}Ra calculated by Microshield
900 = counts per minute per μR/hr for the detector

The value for σ is based on the standard deviation from the background samples collected at the site. Using Equation 5-2 from the Base-wide Plan, Rev. 1, N is calculated as 9 samples.

5.6.2 Determining Data Points for Small Areas of Elevated Activity

The statistical test described above evaluates whether or not the residual radioactivity in an area exceeds the DCGL for contamination conditions approximately uniform across the survey unit. In order to obtain reasonable assurance that any small areas of elevated residual radioactivity are not missed during the FSS, the total number of samples is increased. Equation 4-2 from the Basewide Plan, Rev. 1 (TtEC, 2007) will be used to determine the number of samples. The required number of samples, n_{EA}, was developed for an elevated area based on a survey unit size of 1,000 m^2 and a triangular spacing of L of 8 m. Substituting these values into Equation 4-2 from the Basewide Plan, Rev. 1 (TtEC, 2007), n_{EA} is calculated to be 18.

Equation 4-2 from the Base-wide Plan, Rev 1

$$L = \sqrt{\frac{A}{0.866\, n_{EA}}}$$

Where:

L = length of sample spacing (8 m)
A = surface area of the survey unit (1,000 m^2)
n_{EA} = statistically calculated number of samples

6.0 SYSTEM DESCRIPTION

6.1 BACKGROUND

Until 1958, HPS had a combined sanitary sewer and storm drain system. In 1958, the first of three separation projects was completed. The last of these projects was completed in 1976. These separation projects installed dedicated sanitary sewer piping and pump stations that discharged sanitary sewer effluent off site to the San Francisco treatment plant. In spite of these separation projects, inspections of the systems indicate that some cross-connection of the two systems still exists.

All components of the storm and sanitary sewer systems in Parcels B, C, D, E, and E-2 are considered impacted as documented in the HRA (NAVSEA, 2004). This decision was supported by the following rationale:

- The nature of the original combined sanitary sewer/storm drain system design
- The potential existence of cross-connections
- The uncertainty that radiological contamination from sources within impacted buildings and/or areas may have affected the new sanitary sewer lines after the separation had been completed
- Identification of radioactive contamination in sewer and storm drain lines during previous radiological investigations

6.2 TYPES, SIZES AND DESIGNATIONS OF SYSTEM

The utility drawings identified lines of different sizes and materials for the various systems, as well as lines of unknown size or material composition as described below. However, these descriptions may not accurately represent current, as-built conditions. Actual conditions will be verified in the field as the removal is performed.

6.2.1 Storm Drain System

Where information is available, the storm drain system at HPS appears to be constructed of vitrified clay pipe (VCP), cast iron pipe (CIP), and corrugated metal pipe (CMP). Similar materials are likely present in portions of the storm drain system where information is not available.

Figure 1-1 illustrates the existing storm drain system routing. Typically, the major conveyance routes follow streets, but this is not always the case, and diameter increases as the drainage area increases in size. This system starts as small as 6 inches and increases to 39 inches or larger. The parcel-specific design drawings illustrate the existing system routing and pipe sizing from the historical data available.

Secondary collection systems are dispersed throughout the area and vary from 4 inches to 12 inches. These secondary systems connect with the major routes or directly into an outfall for smaller isolated areas.

6.2.2 Sanitary Sewer System

The majority of the sanitary sewer lines at HPS, as shown in Figure 1-1, range in diameter from 2 inches to 33 inches. Line materials appear to be primarily concrete, VCP, and CIP; however, other piping types may also be present. Sanitary sewer main lines at the HPS include the Crisp Road and Spear Avenue lines. The major conveyance lines coincide with the same routing of the storm drain system along McCann, English, and Lockwood streets and under Building 134 and east of Building 130. Secondary sewer lines connect the buildings, piers, and berths with the major lines noted above.

Sanitary sewers in the Parcel B area are generally serviced by the Lockwood Street Line. The Lockwood Street line feeds the Parcel C Fisher Avenue line, which feeds the Spear Avenue main line. The upper Lockwood Street line services the India Basin berth and drydock area. Additional major lines in Parcel B feeding the upper Lockwood Street line are the McCann and English Street lines.

The northern portion of Parcel C is serviced by the Fisher Avenue line. The Fisher Avenue line is fed by lines from the Robinson Street and Horne Avenue area and the upper Lockwood Street line. Drydock 2 and 3 areas feed the upper Lockwood Street line. Central Parcel C service for the Van Keuren Avenue area is provided by the D Street line, which feeds directly into the Spear Avenue line. Southern Parcel C sanitary sewer service is primarily handled by the Blandy Street Line, which empties into the Spear Avenue main line. The Blandy Street Line handles flow from the Nimitz Avenue line, which is fed by the A Street line and also covers the lower Lockwood Street area.

Parcel D main lines include the Morrell Street and Hussey Street lines, both of which feed the Spear Street main line. The Morrell Street line is fed by the E Street line, with additional feeder lines from the Gun Mole Pier area. The Hussey Street line services a major line from H Street. The H Street line and Hussey Street line interface is accomplished by way of a lift station.

Parcel E major lines are the J Street line, which feeds the I Street Line. The I Street line connects with the Spear Avenue main line. The Crisp Avenue line is also a main line, which feeds directly into Building 819.

7.0 FIELD IMPLEMENTATION

This section describes the specific activities and procedures involved in preparation for, and field implementation of, the removal of existing stormwater and sanitary sewer lines at HPS. It will include restoration of the disturbed areas to a stable, safe condition. The planned activities include:

- Permitting and notifications
- Preparatory activities and meetings
- Environmental resources surveying
- Clearing vegetation
- Initial geophysical surveying
- Topographic surveying
- Mobilization
- Excavation of soils and removal of piping and systems
- Stormwater, sediment, and erosion control
- Radiologically impacted sites
- Radiological surveys and sampling
- FSSs
- Backfill placement and compaction
- Site restoration
- Free-release survey and decontamination of equipment
- Waste classification, storage, and disposal
- Demobilization
- Traffic Control Plan

7.1 PERMITTING AND NOTIFICATION

There are no permit requirements for cleanup operations conducted at HPS. TtEC will obtain necessary authorizations from the HPS CSO for completing the work.

TtEC will maintain a current annual excavation permit from the California Occupational Safety and Health Administration (Cal-OSHA). The required 5-day notification will be provided before excavation begins. Invasive work will be preceded by notification to Underground Service Alert (1-800-227-2600). All excavations will be conducted in accordance with CCR Title 8, Sections 1539–1543, and 29 CFR, Parts 1910 and 1926 requirements. Daily inspections of excavations (specifically trenches) shall be performed by a competent person to assess slope stability and authorization for personnel to work in the trenches.

The DON has a general permit for stormwater discharges at HPS. The removal of the existing storm drain and sewer line network will change the existing drainage flows and outfalls at HPS. The DON will notify the WB in advance of changes to the system that result in new outfalls being installed. This notification will be provided by identifying new outfalls in the parcel-specific design plans that will be submitted for regulatory review. Other changes to the stormwater system will be noted in the DON's annual stormwater discharge reporting.

7.2 PREPARATORY ACTIVITIES AND MEETINGS

7.2.1 Pre-construction Meeting

Prior to commencing field activities for work under a different Parcel-specific Design Plan, a pre-construction conference will be held at the site with the TtEC PjM, Site Superintendent, SHSS, PQCM, the DON RPM, RASO, CSO, and the ROICC. The purpose of the meeting will be to develop a shared vision of the planned work, which includes the following activities:

- Coordination between TtEC, DON, and other parties
- Site health and safety requirements
- QC requirements and submittals
- Preliminary site investigation for underground utilities
- Layout and excavation of affected storm drains and sewer lines
- Radiation monitoring, surveys, and testing
- Removal and disposal of affected piping materials and debris
- Segregation, testing, and disposal of impacted soil
- Backfill of trenches and contouring for drainage

DON site-specific protocol, as applicable to this work, will also be discussed. Minutes of the meeting will be prepared by TtEC and submitted to the DON RPM.

7.2.2 Design Plans

Parcel and work area-specific design plans will be prepared, including drawings and specifications for the removal of the existing storm drain and sanitary sewer systems, backfilling of excavations, and construction of a stormwater surface drainage system with outfalls (if any). The design plans will also include a work plan that will address:

- Parcel or work area-specific layout
- Limits of excavation

- Infiltration control during outfall removal and/or replacement, if any
- Backfilling standards
- Completion of grading and site restoration
- Specifications for replacement piping/structures
- Parcel or area-specific construction schedule.

7.3 ENVIRONMENTAL RESOURCES SURVEY

Prior to mobilization, a qualified wildlife biologist will perform an environmental resources survey to ensure that no special-status species are residing within the limits of the work for each parcel. As appropriate, the EPP, included as Section 9.0, will be implemented for protecting wildlife and biota and following substantive ARARs.

7.4 CLEARING OF VEGETATION

The excavation, access, and work areas disturbed during the removal process will be kept as small as practicable to allow for the effective and safe execution of the work. Prior to any intrusive work, the vegetation will be cleared from the affected area using mechanical means. Vegetation removed from non-impacted areas will be managed as green waste.

7.5 GEOPHYSICAL SURVEYING

A geophysical utility location survey may be performed following a review of existing utility drawings of the affected areas. The geophysical survey would be conducted over the known or suspect areas where underground utilities may exist using ground-penetrating radar (GPR) and/or electromagnetic instrumentation. The results of the geophysical survey will be compared to the available historical drawings and combined with Underground Service Alert markings (if any) to identify locations of underground utilities. Appropriately colored paints (and/or stakes and flags) will be used to mark the identified utilities within the limits of the proposed excavation area. Prior to invasive work, all active systems will be isolated, locked out, and de-energized in accordance with OSHA, Cal-OSHA, and project procedures and protocols.

7.6 TOPOGRAPHIC LAND SURVEYING

Topographic data is available in the Hunters Point Naval Shipyard, San Francisco, California (Base Map [44 Sheets] of November 12, 1993 [Gahagan and Brian, 1993]). This document will be used as the baseline, and subsequent topographic surveys will be integrated into this map. All topographic land surveys will be performed under the direction of a registered land surveyor in the State of California. All surveys will utilize horizontal and vertical control tied to the grid system established for HPS. All equipment used will be in good condition, calibrated, and certified in accordance with the requirements of the State of California for survey equipment and available for review. The surveyor shall provide TtEC with copies of all logbooks, etc., recording the work performed at HPS. All drawings produced by the surveyor shall be reviewed, approved, and sealed by the registered land surveyor supervising the work. These drawings and logs will be maintained as part of the permanent record of survey activities at HPS.

7.7 MOBILIZATION

Mobilization activities will include site preparation, movement of excavation equipment and material to the site, and orientation and training of field personnel. Prior to mobilization, the appropriate DON personnel, including the RPM, RASO, and the CSO, will be notified regarding the planned schedule for mobilization and excavation activities. To arrange for authorized entry badges, field personnel will be provided with a letter to present to the City of San Francisco Redevelopment Agency.

Upon receipt of the appropriate records and authorizations, field personnel, temporary facilities, and required construction material will be mobilized to the HPS. The temporary facilities will include restrooms, security fencing, runoff controls, and one or more secure storage (Conex) boxes for short- and long-term storage of material, if needed. Construction material mobilized to the site will allow for construction of soil screening pads, temporary soil and piping laydown areas, and a waste stockpile area.

Equipment mobilization will be initiated with site preparation activities. Dedicated laydown areas will be used for short-term storage of equipment and material.

Prior to excavation, construction best management practices will be instituted around the proposed excavation area, per the Stormwater Pollution Prevention Plan (SWPPP) (Appendix C).

In addition to the radiological controls set forth in Section 4.0 of this Work Plan, incoming equipment and material will be subject to the following:

- Radiological surveys for existing contamination levels prior to being placed into service.
- One hundred percent scan of accessible areas for alpha/beta contaminants. Swipes will be taken to ensure that no removable contaminants are present. Should any survey results exceed the contamination limits listed in Table 4-3, the equipment will not be placed into service and will be returned to the shipment point of origin.

7.8 EXCAVATION OF SOILS AND REMOVAL OF PIPING AND SYSTEMS

7.8.1 Scope of Pipe Removal

The term "piping" includes all storm drain and sanitary sewer piping and system components that may be encountered during this removal action. Most of the storm drain and sanitary sewer piping at HPS will be removed under this Work Plan. However, limited piping will be left in place permanently or addressed at a later date:

- Piping under the footprint of radiologically impacted buildings and outdoor areas will be evaluated as part of characterizing each building/area and will not typically be removed under this Work Plan.
- Piping laterals originating at non-radiologically impacted buildings will initially only be removed within the first 10 feet of their union with a main trunk line. If no radiological contamination is present in this segment of the line, then the exposed ends of the lateral will be capped or plugged and the remaining portions left in place. If evidence of radiological contamination is encountered, the remaining lateral will be removed in 10-foot sections until the line has been determined to be free of radioactive contamination or to the face of an existing building if encountered, whichever comes first.

7.8.2 Excavation Approach

The general approach to removing the storm and sanitary sewer lines will be to remove the overlying pavement, excavate the soils, and subsequently remove the sanitary sewer and stormwater drain lines. Soils will be excavated a minimum of 1-foot around and below the pipe. Radiological screening and sampling will be performed ex-situ on pipe. Open sanitary or storm sewer lines left in place during the removal process will be plugged to prevent water from entering or exiting pipes. FSSs will be performed on ES and exposed excavated trench surfaces. After the results of these activities are evaluated and any identified radiological contamination is removed, the trenches will be backfilled and the site restored, with concurrence from the RASO.

Excavation activities include the removal of overlying surface pavement (where present) from the limits of the excavation. This material will be segregated and evaluated for potential reuse as granular surface material, subject to the approval of the DON, or will be disposed of in accordance with Section 8.0.

After the removal of the surface paving, the soil overlying each storm and sanitary sewer line (the ES) will be removed and transported to the designated RSY for subsequent survey and sampling activities. ES removed from within an identified IRP site will be managed separately from other IRP sites. ES removed from non-IRP site areas will be managed so that, once free released, it can be returned to the general area from which it was excavated.

Following removal of the ES, the stormwater and sanitary sewer pipelines will be removed. To the extent practicable, the pipes will be removed and stockpiled separately. If the piping cannot be extracted separately, as may be the case for terracotta pipe, the piping will be stockpiled, sampled, and surveyed as ES.

Where practicable, pipe segments shall be removed intact. The pipe will be placed in designated stockpile/laydown areas within the radiologically controlled area from which it was removed to allow for radiological characterization and sampling as required. Excavated piping will be considered radiologically contaminated until survey and sampling data prove otherwise, and it shall be controlled as radioactively contaminated material and handled accordingly. Every effort will be taken to contain silts and debris that may be inside the pipe. If sufficient sediment is present within removed piping, a minimum of one sample will be collected for radiological analysis.

Open sewer or storm drain lines left in place during the removal process will be plugged to prevent water from entering or exiting pipes and to substantially eliminate the release of any contamination that may be present in the lines. In no case will sediments from removal or installation work be allowed to enter the Bay.

If it is practical and required to remove piping from a radiologically impacted site under this Work Plan, an initial surface radiological survey will be performed to identify surface and near-surface (less than 30 cm [12 inches] bgs) radioactive material for subsequent removal and proper on-site storage pending disposal through the DON Low-level Radioactive Waste (LLRW) Disposal Program.

7.8.3 Stockpile/Laydown Pads

ES and piping will be placed on stockpile/laydown pads for storage, sampling, and/or radiological screening. A RSY will be constructed for each project, as appropriate. The RSY placement and orientation will be concurred upon by the RASO prior to use. The RSY will be constructed in a manner to allow for dewatering of wet soils prior to survey activities. In addition the RSY will be posted as an exclusion area when in use, in accordance with the appropriate SOP.

Screening pads in the RSY will be designed to handle a maximum of 1,000 m^2 of soil spread out to an approximate 6-inch depth. The pads will be constructed of 20-mil high-density polyethylene (HDPE) or polyvinyl chloride (PVC) liner material laid directly on the ground after the ground surface is cleared of rocks, debris, and other items that could puncture the liner. In accordance with the SWPPP (Appendix C), the screening pads will be protected with a 6- to 8-inch-high berm to prevent surface water runoff from coming into contact with the stockpiled material in accordance with the RCRA staging pile regulations of 40 CFR, Part 264.554, and Section 25123.3 of the California Health and Safety Code provision for stockpiling of non-RCRA hazardous soil. The liner will be extended over the berms surrounding the screening pads to ensure that material placed on each pad is contained.

Water collected from the screening pads will be characterized for chemical and radiological constituents, and before being disposed of properly. Wastewater sampling will be conducted according to the procedures detailed in the SAP (Appendix A).

Once radiologically cleared, ES from an IRP shall be moved to a separate stockpile area for additional chemical analysis. Based on chemical sampling analytical results, material not suitable for backfill may be consolidated for off-site disposal. Materials meeting the chemical sampling analytical criteria will be used as backfill in the appropriate IRP.

7.8.4 Other Considerations

Throughout the excavation process, soil and piping shall be visually inspected for staining or odors. Material that emits odors or is stained shall be segregated for further sampling and analysis per the SAP. If gross visual contamination is identified outside the bounds of an IR site, up to the first 500 cubic yards of material excavated from an area of a non-IR site adjacent to the IR site will be segregated, sampled, and analyzed for chemical analyses as described in the SAP. This approach will be considered on a case-by-case basis. The need to collect samples will be based on professional field judgments and observations.

During trenching and pipe removal operations, sidewall slopes can be left un-sloped (vertical cut). Excavators can slope the sidewalls to facilitate pipe removal as designated by the Field Engineer. For deep excavations where sloping is impractical, an alternative shoring plan must be approved by a California state-registered engineer of his/her designated competent person. The engineer or the designated competent person will discuss any shoring to be performed with the radiological/sampling group to ensure that the shoring will not interfere with sampling and gaining acceptance for radiological clearance.

A grab soil sample will be collected from the bottom of the excavated trench section where evidence exists of a breach in the sewer/storm drain structure. A breach will be defined as: 1) gap/crack/break in the pipe segments, 2) abrupt end to a pipe (open ended), 3) missing section of pipe/conduit, and 4) other visible signs of pipe/conduit failure/leakage. The sample will be analyzed for radioactive materials and the chemicals of concern associated with upgradient sources.

The length of the open trench will be maintained at a practical distance to allow for an efficient execution of the work and stay within the guidelines of the SWPPP.

Personnel shall not enter any open trench unless proper sloping/benching is in place. Sloping/benching must be approved by a California-state registered engineer or his/her designated competent person as previously stated in the Work Plan. CAL-OSHA rules and regulations for stabilizing (sloping or benching) trenches to enable people to enter will continue to apply.

Additional soils may be removed beyond the initial excavation if sample and survey data confirm the presence of radioactive material.

Sandblast grit encountered during excavation activities will be handled in accordance with the RASO-approved work instruction specifically written to govern this material. In addition, a spotter will be used at all times during excavation activities. The spotter will be trained in recognizing sandblast grit, as well as underground utilities. Any sandblast waste will be segregated and properly disposed.

In cases where the excavation is located in an area of known radiological contamination, the soils may be directly loaded into bins for characterization and processing as waste.

If buried drums, bottles, jars, and/or other unidentified containers are located during removal actions, they will be handled in accordance with the Buried Drums, Bottles, Jars, and Containers with Unknown Content Procedure (Attachment 1). The procedure addresses the identification and inspection of buried containers, their recovery and removal from the excavation, hazardous categorization, waste categorization sampling, temporary staging on site, and disposal that will be followed once a container is encountered during the excavation activities.

7.8.5 Well Destruction

During removal actions, wells located in the excavation footprint will be preserved if possible. If preservation is not possible or deemed unnecessary by the DON, wells may be abandoned. When it is known that abandonment of a well is necessary prior to excavation, well destruction permit requirements will be met prior to abandoning existing wells. Because the project is being completed under CERCLA authority, permits and inspections are not required.

Regardless of whether or not the well abandonments were anticipated, the groundwater extraction wells and piezometers will be abandoned when necessary in a manner consistent with the specifications. The procedures for abandoning wells or piezometers are as follows:

- Well construction logs and/or boring logs will be reviewed for location of any confining layer. In addition, historic groundwater monitoring data, if available, will be reviewed.
- The depth of the well or piezometer will be measured using a water level sounder to confirm the required depth for overdrilling and to estimate the amount of sealing material required.
- The well monument and wellhead will be removed prior to overdrilling the well or piezometer. The well monument and wellhead will be surveyed for radioactive contamination and disposed of based on survey results (for example, with the debris from the fill area as clean waste or as segregated radioactive waste).
- Based on historic data review, if light non-aqueous phase liquid (LNAPL), or dense non-aqueous phase liquid (DNAPL), are suspected, the borehole volume of groundwater in the well will be purged and containerized for characterization and disposal.
- The well or piezometer will be overdrilled to a depth of no more than 6 inches below the well screens and end caps using hollow-stem auger methods. In addition, care will be taken so that confining units are not penetrated during overdrilling. The

overdrilling auger diameter will be at least 2 inches larger than the existing well or piezometer diameter. Wells suspected of having LNAPL or DNAPL will be overdrilled after purging to minimize the possibility of mobilizing NAPL in the surrounding environment. The components used inside the wells, such as the drilling auger, will be surveyed for radioactive contamination.

- If radioactive contamination is found, the boring will be documented for a future removal action, and the borehole will be backfilled with a mixture of bentonite and cement slurry to a depth 1 foot below the anticipated bottom well or piezometer. Bentonite will be used to seal the remainder of the borehole. Bentonite pellets used in the vadose zone will be hydrated as each 1.5- to 2-foot section is placed in the borehole. The planned cement to bentonite mixture for the well borehole backfill will be 5 to 10 percent bentonite.

- If no radioactive contamination is found, the borehole will be backfilled with a mixture of bentonite and cement slurry to a depth 1 foot below the anticipated bottom of the excavation. Bentonite will be used to seal the remainder of the borehole. Bentonite pellets used in the vadose zone will be hydrated as each 1.5- to 2-foot section is placed in the borehole. The planned cement to bentonite mixture for the well borehole backfill will be 5 to 10 percent bentonite.

- To prevent bridging during backfilling, the sealing material will be placed via a tremie pipe, proceeding upward from the bottom of the borehole. The sealing material will be placed in one continuous operation (or "pour") and allowed sufficient time to settle.

- Records will be kept of the volume of sealing material placed during destruction operations to ensure that it is consistent with the calculated borehole volume. This will ensure that the well or piezometer has been properly destroyed and that no bridging of backfill material has occurred.

- Waste materials resulting from overdrilling each well or piezometer, such as soil cuttings and well casing remnants, will be placed on a lined stockpile area pending screening and sampling for the presence of radioactive material. Radioactive materials identified in the drill cuttings will be removed and disposed of appropriately in accordance with the Waste Management Plan (WMP) requirements. If radiologically cleared, the soil cuttings, well monuments, casings, and other debris resulting from well or piezometer abandonment will be hauled off site for disposal at an approved disposal facility.

- The auger flights will be surveyed for radioactive contamination and subsequently cleaned prior to overdrilling each well or piezometer. Auger decontamination will be performed within a self-contained decontamination trailer. If such a trailer is unavailable, a temporary equipment decontamination pad, consisting of a bermed polyethylene liner, will be constructed to facilitate collection of any generated wastewater. Decontamination wastewater will be collected in an on-site temporary storage tank pending sampling, analysis, and off-site disposal. Waste profiling will be performed in accordance with the SAP (Appendix A).

7.9 STORMWATER, SEDIMENT, AND EROSION CONTROL

For this project, Appendix C provides an SWPPP that addresses specific installation and maintenance of appropriate Best Management Practices (BMPs) for controlling stormwater. The SWPPP was prepared in accordance with SWRCB requirements; however, a general National Pollutant Discharge Elimination System (NPDES) stormwater construction permit is not required because site activities are being conducted under Section 121(e) of CERCLA.

Releases to water and land will be prevented through the implementation of the BMPs presented in the *Erosion Control Field Manual* (Friends of the Estuary, 1998) and the *California Stormwater Best Management Practices Handbook* (Camp, Dresser, and McKee, 1993).

7.10 RADIOLOGICALLY IMPACTED SITES

If it is practical and required to remove piping from a radiologically impacted site under this Work Plan, additional radiological surveys will be performed prior to intrusive work.

7.10.1 Initial Surface Scans

Initial surface scans for radiation will be performed if piping is to be removed from a radiologically impacted site. Radiological surface scans will be conducted in accordance with the Base-wide Plan, Rev. 1 (TtEC, 2007) and the TtEC SOP for radiation and contamination surveys. The initial surface survey will encompass an area that extends beyond the excavation boundaries, including soil and storm drain line laydown areas. The survey will be performed using Ludlum Model 2350-1 data loggers with Ludlum Model 44-10 NaI probes. This survey will be completed and the results accepted prior to beginning invasive activities. Vegetation will be cleared prior to the surface scan.

7.10.2 Removal of Radioactive Material

If radioactive material is identified and confirmed during the initial surface scan, coordinates will be recorded and the location marked or flagged. The field survey team or the data group analyzing collected field information will notify the TtEC RSO and the RTM. The TtEC RSO will notify the RASO. Radiological support personnel under the supervision of an RCT will remove the radioactive material as directed by the RSO.

Areas known or suspected to contain radioactive material will be isolated pending removal of the material. The assigned RCT will ensure that the removal action will first be evaluated by the RTM for radiological impact.

Typical removal actions will involve an area within a radius of 1 foot around the coordinates of the suspected radioactive material. Under RCT oversight, the location with an elevated radiation level will then be excavated and placed directly into a waste bin. Soil removal will continue until the source of the elevated gamma activity is removed, based on survey results. Following removal of the source of elevated gamma activity, an additional foot of soil in all directions from the source will be removed and disposed of as radioactive waste. After the radioactive material and surrounding soil is excavated, the resulting pit will be resurveyed by the assigned RCT. If elevated gamma emitters persist, further examination of the soil will be made until the source of high gamma radiation is found and removed.

If the source of elevated radioactivity cannot be readily identified as a point source and removed, the material will be sampled and placed into a waste bin for disposal. If the radioactive material is a point source, it will be given a unique identification number and recorded in a logbook and on the drum inventory sheet. Radioactive point sources will be placed in plastic bags within metal drums and stored in a designated and posted radioactive material storage area for subsequent packaging and disposal by a certified waste broker under the direction of the DON LLRW Disposal Program.

7.11 RADIOLOGICAL SURVEYS AND SAMPLING OF EXCAVATED MATERIAL

Soil overlying each storm and sanitary sewer line will be removed. This soil will be surveyed and sampled for unrestricted use as backfill. The pipelines will be removed separately. Additional soils may be removed if sample and survey data confirm the presence of radioactive material above the RROs.

7.11.1 Piping

In-place and excavated piping, components, and large debris will be screened manually for alpha and beta/gamma emitters. When present, samples of sediment will be collected from the interior surfaces of extracted piping and components and analyzed by gamma spectroscopy. Swipe samples will also be collected from interior and exterior surfaces to identify the presence of removable surface contamination. Swipe samples will be analyzed on site using a gas-flow proportional alpha and beta/gamma radiation counter. The piping will be surveyed to preclude release of radioactive materials that may be affixed to the exterior and interior surface areas of the piping. The release criteria for piping can be found in Table 4-3. In instances where surveys cannot be performed, such as broken and crushed piping, the pipe will be managed as ES. Radiologically contaminated material identified during piping surveys will be stored at the originating site pending disposal.

Additional samples will be analyzed for ^{90}Sr if ^{137}Cs activity above the release criteria is identified during field laboratory gamma spectroscopy analysis.

Excavated debris and piping components not radiologically contaminated will be transported by truck to a temporary laydown area where they will be stockpiled. These wastes subsequently will be transported off site for disposal at a CERCLA Off-site, Rule-approved landfill. Trucks transporting these non-radiological wastes will pass through the on-site portal monitor prior to exiting HPS.

Trench segment piping identified as having radioactive materials present above the RRO will require further trench sampling to characterize the extent of contamination, as directed by the RSO. No scoping survey will need to be performed on these trench units.

7.11.2 Extraneous Piping

The site has experienced numerous changes and additions to its subsurface piping throughout its long history of operation. During excavation activities, it is anticipated that non-stormwater and non-sanitary sewer pipelines will be encountered. Those non-stormwater/non-sanitary sewer pipelines that have the potential to be liquid bearing will be treated as extraneous pipe (EP). Encountered pipelines that do not have the potential to be liquid bearing or that have been identified on historical drawings as fresh water, electrical, communication or air lines will not be treated as EP, but will identified, as necessary, on the final record drawings for each project under this removal action. In addition, piping encased in concrete not associated with the stormwater/sanitary sewer system will be assumed to be electrical conduits and will not be treated as EP.

A unique EP identification number will be assigned to each EP as it is identified in the field. A description of the EP is obtained by the Field Engineer and communicated to the Project Engineer. To the extent practicable, EP will not be breached and will be left intact during excavation activities. The EP will be marked with the appropriate EP identification number at the time it is identified. Broken EP will be placed on plastic in the excavation laydown area and the EP identification number will be placed on the removed portion of the pipe as well as on any of the EP remaining in the trench.

If there is a sufficient quantity of the material, a sediment sample will be collected from the removed portion of an EP by the on-site laboratory by gamma spectroscopy. In addition, an interior and an exterior swipe sample will be collected and analyzed. If radiological contamination is identified, excavation activities will continue along the EP to remove the contaminated pipe.

EP not removed or broken at the time of excavation will be labeled with the appropriate identification number. The Site Superintendent will schedule a “hot tap” on the pipe to identify any potential liquid or gas in the EP. Once the hot tap is completed and the SHSS has performed the appropriate checks for hazardous gasses or liquids, the EP will be cut and swipe samples will be collected from the interior of the piping remaining in the trench and will be analyzed by the on site laboratory for potential radiological contamination. If no contamination is identified, the EP will be backfilled along with the trench. If contamination is identified, the EP will continue to be excavated and will be treated in the same manner as stormwater/sanitary sewer piping and the associated ES.

7.11.3 Excavated Soils

ES will be transported to a screening pad for subsequent dewatering (if necessary) and radiological surveys. ES placed on the screening pads will be spread out in lifts not to exceed 6 inches in height and up to 1,000 m^2 in surface area. As necessary, the material will be allowed to dewater prior to performing radiological surveys. The radiological surface survey will consist of a high-density gamma scan performed with the use of NaI detectors and supported by GPS equipment. The high-density survey process will result in a 100 percent scan survey, as detailed in Section 4.0 of this Work Plan. Radioactive material identified during screening activities will be collected, segregated, and stored in appropriate containers for subsequent packaging and disposal under the direction of the DON LLRW Disposal Program as directed by the RSO.

Collected field data will be logged and survey points plotted on survey unit grid maps to document survey results. These data will be used to directly tie the locations of any elevated radiation measurements to the corresponding grid coordinates, which will be established during the development of the systematic sampling plan. Data analysis will be performed as it is received, and questionable areas will be flagged in the field for resurvey/verification. Locations where surface radiation levels appear to be greater than 3 sigma of the mean background level will be noted on a subcontractor-provided grid map. Hand-held equipment featuring NaI detectors will then be used to perform static readings and verify the elevated measurements. Areas confirmed as having radiation levels greater than the established 3 sigma of the mean background area level will be evaluated further for the presence of radioactive material and may include additional biased sampling. If radioactive material is confirmed, the area will be physically marked and the associated radioactive material removed.

A minimum of 18 systematic solid samples will be collected for each survey unit of ES (up to 1,000 m^2) placed on the screening pad for Scoping Survey and FSS. Any contamination found in ES will be characterized and remediated as directed by the RSO. Remedial action support surveys will be performed until post remediation sample results are less than the RROs. Scoping survey sample data may be used as the FSS if all sample results are less than the RROs.

Scoping survey and FSS samples will be systematically collected based on a random start point and sample spacing using Equation 4-2 from the Base-wide Plan, Rev. 1 (TtEC, 2007), as shown in Section 5.2, using the most current version of VSP. Additional samples will be collected at locations where the investigation level is exceeded. The samples will be analyzed at the on-site radiological laboratory by gamma spectroscopy. ES determined to have residual radioactive contamination below the RROs after a single phase of systematic sampling may be used as backfill, pending additional chemical analysis.

7.11.4 Outfall Removal or Replacement for Activities in Parcels B, C, D, E, and E-2

Outfalls to be located or removed along the shoreline that are greater than +8 feet vertically from mean lower low water (MLLW) and/or outfalls to be located or replaced along structures will be removed and/or replaced in accordance with the parcel-specific design plans. No other special controls are required for these outfalls.

Outfalls to be located or removed along shorelines less than or equal to +8 feet vertically from MLLW, but greater than or equal to MLLW will be installed/removed during periods that lack tidal influence of the work; this area is defined as the intermediate zone. Sediment controls will be in accordance with the applicable parcel design plan under this Work Plan, and controls will be in accordance with the applicable parcel design plan under this Work Plan, and must be used for any work in the intermediate zone. Soils not disturbed during the removal process are specifically exempted from survey under this Work Plan. Radiological controls when working in the intermediate zone will be designed to substantially eliminate the spread of contamination to areas outside the intermediate zone. Areas where outfalls are to be located or removed that fall in this intermediate zone are not suitable for free release under this Plan, and may be considered under separate work plans, task-specific plans, work instructions, or with other studies of Parcel F at HPS.

For shoreline work in the intermediate zone, riprap temporarily will be relocated to adjacent areas inside the intermediate zone for replacement in the original area, and will not be surveyed under this Plan. Keel blocks acting as riprap will be removed and surveyed in accordance with an approved keel block work instruction. All riprap will be subjected to radiological screening prior to leaving the intermediate zone. Conversely, if riprap does not leave the intermediate zone it does not require radiological screening. All soil removed from under riprap located on these shorelines inside the intermediate zone will be handled as ES under Section 7.11.3. Excavation areas and trenches in the intermediate zone will be backfilled with approved, new import materials as soon as practicable, once work has been completed in this zone, to prevent sediments from entering the Bay during rain events.

Existing shoreline outfalls that lie below MLLW will be removed to the maximum extent possible in the intermediate zone, and, during low tide events, they will be cut, capped, and/or abandoned at MLLW. The point that the outfall is abandoned will be recorded to facilitate further study or removal with Parcel F work at HPS.

Outfalls to be located or removed along structures will be removed to the maximum extent possible above MLLW during low tide events. Portions of these outfalls that lie below MLLW will be abandoned at MLLW, and the approximate location of abandonment recorded. Specific controls required for work are dependent on the structure, and will be further detailed in parcel-specific design plans. Sediment control plans, required when working on outfalls located less than or equal to +8 feet from MLLW, will be detailed in each specific design plan.

Outfalls that must be installed below MLLW will have specific engineering controls in place to maintain the water level inside the area of control at least one foot below the working level, as defined in Section 7.8.2.

7.12 TRENCH SURVEYS

Following completion of excavation activities, scoping surveys of each trench unit will be completed. If the scoping survey sample results are less than the RROs, then the scoping survey data will be used as an FSS, and backfilling or limited storm drain replacement will be acceptable with the concurrence of the RASO. Scoping and FSSs will include systematic sampling, collected after establishing a grid consisting of cells not to exceed 1,000 m^2 over the excavated trench surfaces (sidewalls and bottom). Systematic sample collection locations will be generated using the most current version of VSP. Additional surveys will be performed if the investigation levels are exceeded.

Any area from a trench that indicates radioactive materials present above the RROs will be characterized and remediated. Remedial action support surveys will be considered completed when post remediation sample results do not indicate activity above the RROs. A FSS will be performed on each trench unit after the remedial action support survey has concluded.

Trench units will be considered acceptable for backfill or limited storm drain replacement when no contamination is found above the RROs during a single phase of systematic sampling, either from a scoping survey or an FSS.

7.13 BACKFILL PLACEMENT AND COMPACTION

When the results of the surveys and sampling confirm that contamination above the RROs has been removed and with concurrence from the RASO, the excavation trenches will be backfilled. Two sources of backfill material may be available for use. The first is radiologically released ES removed during the excavation. In the case of ES excavated from IRP sites, the ES will be segregated, sampled and analyzed. If the chemical results meet the screening criteria listed in the SAP (Appendix A), the soil may be used to backfill where the criteria meet the intended reuse. Soil that meets the industrial reuse criteria will only be used in industrial and open space reuse areas. Soil that meets residential criteria may be used as backfill at any location. To the extent practicable, ES meeting the appropriate backfill criterion will be placed in trenches as close to the original excavation trenches as possible. The second source is imported material. Import soil shall be sampled and analyzed per the SAP and in accordance with the approved Backfill Review Analytical Procedure (HPO-Tt-270) and will be approved by the RASO prior to use. Backfill and compaction requirements will be performed in accordance with the specification provided in each design plan. Backfill shall be placed to the lines and grades as specified in the design plans to assure surface drainage. A final topographic survey will not be performed. When possible, trenches will be backfilled to approximately their original grade prior to excavation. Areas where a new drainage swale will be installed will be backfilled to the level indicated in the associated design drawings.

7.14 SITE RESTORATION

In most areas of HPS, post-backfill site restoration will consist of installing surface drainage swales to direct overland stormwater runoff to outfalls along the San Francisco Bay shoreline. Installing replacement subsurface stormwater piping will be limited to those areas where they are required to properly direct stormwater flows to San Francisco Bay and comply with stormwater discharge requirements. The locations of subsurface replacement lines will be identified in the design plans. No sanitary sewer lines will be replaced.

Any damage to the surface or subsurface elements of the in-place fire protection system resulting from this removal action will be repaired.

The surface drainage swales may coincide with roadway locations. The design plans will provide the locations and details that will allow for the safe combined use of vehicles and stormwater. Swale design will consider the intended vehicular traffic. Disturbed roadways will be repaired using compacted granular materials, unless traffic or stormwater conveyance requirements require other materials.

7.15 DECONTAMINATION AND FREE-RELEASE SURVEYING PROCEDURES

7.15.1 Equipment and Material

Free-release surveys consisting of a 100 percent scan of accessible areas for alpha/beta contamination will be conducted on equipment and tools subsequent to demobilization and decommissioning. Swipes will be taken to ensure that no removable contamination is present. Free-release criteria will meet the limits established in Table 4-3 for material and equipment. Should the levels exceed those listed in Table 4-3, the equipment will not be permitted to leave the site, and appropriate decontamination will be performed. If equipment survey results are below the free-release criteria listed in Table 4-3, the equipment will be released to the equipment rental vendor.

Equipment or material that cannot be easily or cost-effectively decontaminated will be evaluated for possible limited use in radioactive material use areas, or disposed of as radioactive waste. The guidance of TtEC's applicable SOP(s) governing decontamination of equipment and tools shall be followed when equipment and material decontamination is necessary.

Surveys will be documented and given a unique survey number.

7.15.2 Personnel

If during the course of routine personnel surveys, contamination is detected, and the need is identified for personnel decontamination, it shall be performed per the SOP HPO-Tt-022 governing radiological protective clothing selection, monitoring, and decontamination. TtEC will also notify RASO of any personnel contamination incident.

7.16 WASTE CLASSIFICATION STORAGE AND DISPOSAL

All waste materials as a result of this activity shall be controlled and managed in accordance with Section 8.0, the WMP.

7.17 DEMOBILIZATION

Upon completion and acceptance of the work, construction materials, equipment, and debris will be removed from the area. All temporary access and traffic control measures shall be removed. As required, construction equipment will be decontaminated, inspected, and accepted by the RTM, SHSS, and the Site Superintendent.

7.18 TRAFFIC CONTROL PLAN

Off-site impacts to traffic outside of HPS are expected to be minimal due to this project. Daily traffic load associated with construction personnel entering and leaving the site will be offset by reductions in tenant traffic. The remaining impacts will be limited to waste and imported soil transportation and mobilization and demobilization of construction equipment. To the extent possible, waste transportation will be restricted to non-peak traffic hours to minimize the impact to the surrounding community. Mobilization and demobilization of construction equipment are one-time events, and therefore will not adversely impact traffic flow outside HPS.

In contrast, traffic flow within HPS will periodically be altered significantly during this project, as many streets will be wholly or partially closed to excavate storm drain and sanitary sewer lines. Appropriate traffic control measures on site will be selected in the field based on actual field conditions at the active work areas. Specific traffic safety and control measures that will be implemented are summarized below. These safety and control measures shall conform to the applicable specifications of the *Manual of Traffic Controls for Construction and Maintenance Work Zones* (California Department of Transportation, 1996).

The project team will coordinate construction activities that may generate traffic impacts with the CSO and the ROICC in order to avoid conflicts with other activities being performed concurrently at HPS.

7.18.1 Traffic Safety Measures

In order to expedite the passage of facility traffic through or around the work areas and within HPS, TtEC will install and maintain necessary signs, temporary railings, barricades, and other facilities for the sole convenience and direction of facility and tenant traffic. TtEC will furnish competent flaggers whose sole duties will be to direct the movement of facility traffic through or around the work areas and to give adequate warning to facility personnel and tenants of any dangerous conditions to be encountered.

Water and dust abatement measures will be applied to the on-site roads that will be used by construction vehicles for alleviation or prevention of dust nuisance.

Materials or equipment will not be stored where they may interfere with the free and safe passage of facility personnel and tenants. At the end of each day's work and at other times when construction operations are suspended for any reason, TtEC will remove equipment and other obstructions from that portion of the roadway for use by facility and tenant traffic. In addition, TtEC will adhere to all facility speed limit requirements.

7.18.2 Traffic Controls

Traffic controls will be used to provide for the efficient performance of the work in a safe working environment while minimizing the impact on normal traffic flow. Traffic controls will be required during construction activities to provide for equipment operations and truck loading for on-site and off-site transportation. Traffic controls may include, but are not limited to, the following:

- Loading and transport of waste and debris will be scheduled to minimize disruptions to facility traffic.
- Transportation demand management strategies such as car/van pool for construction workers will be encouraged.
- Transport trucks removing waste and debris from site areas will be scheduled to avoid queuing along major streets. Close coordination between TtEC and the truck dispatcher will be maintained at all times during loading and unloading activities.
- A sufficient area to park passenger vehicles on site in the support areas and haul trucks in the exclusion zones will be provided.
- Cones, flags, signs, and other traffic control measures, as needed, to facilitate loading and unloading will be used.
- To facilitate safe traffic patterns, as necessary, trench plates may be used over open excavations.

During non-construction periods, non-applicable signs will be covered with black plastic or temporarily removed.

Other project-specific measures will be used to minimize the impacts of the proposed construction activities. These measures include the following:

- Proper design geometrics will be applied to access driveways and all internal streets to accommodate trucks and fire apparatuses.
- Clean access points for trucks will be maintained at the project entrance to allow for efficient movement of construction traffic and expedite the entry and exit of construction vehicles.
- An adequate turning radius will be provided in all areas, including loading areas near the stockpiles.
- Sufficient area will be provided for parking vehicles on site during construction, including space for haul trucks.
- Close coordination will be maintained between the DON and other facility contractors to ensure safety and to minimize impacts to other activities within HPS.

8.0 WASTE MANAGEMENT PLAN

The purpose of the WMP is to present the waste management practices and procedures to be followed for the types and quantities of waste expected to be generated during the field activities associated with the removal activities during the base-wide sanitary and storm drain system radiological characterization and remediation. The WMP identifies waste management activities conducted during the storage and the preparation and/or disposal of waste (including waste characterization, packaging, storage, and management while in storage). The transportation and disposition of waste material at appropriate disposal and recycling facilities are also included.

The WMP provides information on how wastes, including potentially hazardous wastes, LLRW, and/or low-level mixed waste (LLMW) associated with project activities will be managed and disposed of. A secondary goal of this section is to ensure that waste minimization practices are followed, to the extent practicable, to reduce the volume of waste that will be generated, stored, and removed from the site for disposal.

8.1 PROJECT WASTE DESCRIPTIONS

Site activities will consist of excavation of buried sanitary sewer and storm drain piping and associated soil, and stockpiling and radiological screening of removed material and restoration areas where excavation has occurred. Waste generated during this remedial action will either be radiological or non-radiological in nature.

LLRW and/or LLMW wastes anticipated to be produced may include, but may not be limited to:

- Soil/sediment
- Debris (including piping and system components)
- Wastewater

Non-radiological wastes anticipated to be generated may include, but may not be limited to:

- Soil/sediment
- Debris (including piping, components, and concrete/asphalt)
- Wastewater

The following disposal options will be applied to the wastes described above:

- Soil, debris, and wastewater intended for off-site disposal and classified as a Toxic Substances Control Act (TSCA) hazardous, RCRA hazardous, or non-RCRA (California) hazardous waste will be transported to a CERCLA Off-site, Rule-approved hazardous waste facility for treatment and/or disposal.

- Soil not originating from an area within an IR site and not radiologically contaminated, may be used as backfill for the excavation.
- Debris intended for off-site disposal and classified as non-hazardous waste will be transported to a CERCLA Off-site, Rule-approved waste facility.
- LLMW will be properly stored on site pending packaging and disposal by a certified waste broker at a permitted LLMW disposal facility.
- LLRW will be properly stored on site pending packaging and disposal by a certified waste broker at a permitted LLRW disposal facility.
- Cleared vegetative wastes that do not exhibit elevated levels of radioactivity will be disposed of at an off-site green waste recycling and disposal facility.
- Wastewater will be characterized and profiled for appropriate off-site treatment and/or disposal.

Use of any disposal facility for LLRW and LLMW is subject to approval by the DoD LLRW Executive Agency (Army).

8.2 WASTE MANAGEMENT FOR HAZARDOUS/NON-HAZARDOUS WASTES

In accordance with the ARARs, the substantive requirements of the state and federal hazardous waste generation, characterization, storage, treatment, and management regulations of Title 22 CCR, Sections 66261, 66262, and 66264, and 40 CFR, Parts 261, 262, and 264, are applicable to the management of hazardous wastes generated during the investigation activities and associated project activities.

8.2.1 Waste Classification

According to RCRA requirements of Title 22 CCR, Section 66261.10, waste characteristics can be measured by an available standardized test method or be reasonably classified by generators of waste based on their knowledge of the waste, provided that the waste has already been reliably tested or if documentation exists of chemicals used.

A waste determined not to be a RCRA-hazardous waste may still be considered a state-regulated non-RCRA hazardous waste. The state is broader in scope in its RCRA program in determining hazardous waste. Title 22 CCR, Section 66261.24(a)(2), lists the Total Threshold Limit Concentrations (TTLCs) and the Soluble Threshold Limit Concentrations (STLCs) for non-RCRA hazardous waste. A waste is considered hazardous if its total concentrations exceed the TTLCs or if the extract concentrations from the Waste Extraction Test (WET) exceed the STLCs. A WET is required when the total concentrations exceed the STLC by a factor of 10, but are less than the TTLCs. California also has additional hazardous waste classification criteria (including 96-hour fish bioassays) that may need to be considered on a case-by-case basis. Wastes determined to be hazardous wastes under California regulations and not under federal regulations are referred to as non-RCRA hazardous wastes.

The waste classification requirements also apply to water generated from daily decontamination activities, dewatering of excavation material, collected stormwater, and waste oils and fluids (if any) generated from the on-site project equipment. Wastewater resulting from excavation stormwater runoff, dewatering, and decontamination water will be collected and contained in tanks or other appropriate containers. When the container is approximately half-full or at least every 45 days, whichever occurs first, it will be sampled to determine proper disposition of the wastewater. PPE will be characterized based on generator knowledge and will be disposed of at an off-site landfill. Waste oils and fluids (if generated) will be sampled for off-site disposal.

8.2.2 Waste Accumulation and Storage

Regulations per 40 CFR, Part 262, and 22 CCR, Section 66262, are applicable to the generation, storage, management, and accumulation of RCRA and non-RCRA hazardous wastes, respectively. Specific requirements apply to the accumulation time for hazardous wastes on site and to the accumulation and labeling of hazardous wastes. This project may result in the temporary accumulation of hazardous wastes. These wastes will be managed, accumulated, and inspected in accordance with the regulations.

8.2.3 Soil

Hazardous and non-hazardous soil may be generated during excavation of sanitary sewer and storm lines. Soil excavated from within IR sites will be stockpiled as described in Section 7.0 and sampled and analyzed for final disposition or potential reuse, if it meets import fill Preliminary Remediation Goals. Soil excavated from areas outside of IR sites will be stockpiled pending return to the excavation as fill material, minus any soil considered LLRW or soils with visible staining or odor. The operation and maintenance of the stockpiles will conform to the requirements of RCRA staging pile regulations of Section 264.554 of 40 CFR and with Division 20, Chapter 6.5, Section 25123.3 of the California Health and Safety Code.

8.2.4 Debris

Debris, including terracotta and concrete piping, will be stockpiled pending disposal as non-hazardous debris. All associated material will be removed from the piping prior to stockpiling. If staining is observed or contamination is suspected debris will be characterized to meet the disposal facility requirements. Other debris that may be generated may include asphalt and/or concrete, which may be reused on site or disposed off site.

8.2.5 Wastewater and Waste Fluids

Facilities that store hazardous wastes in tanks or containers for over 90 days are expected to follow applicable requirements contained in 22 CCR, Section 66264, and 40 CFR, Part 264.

Any wastewater generated (for example, decontamination water generated from equipment and personnel decontamination and water generated from dewatering excavated material) will be collected in containers such as Baker tanks, Rain for Rent® tanks or 55-gallon drums and labeled as "Potentially Hazardous Water – Pending Analysis." An accumulation start date will be noted on the label. Tanks will be temporarily staged within a pre-designated and secondarily contained (unless tanks are double-walled) on-site waste accumulation area pending characterization and appropriate disposal. Tank trucks or drums will be used to transfer water from the point of generation to the tank storage area. Wastewater generated from hazardous and non-hazardous waste and/or decontamination activities will be segregated from wastewater generated from radioactive decontamination.

When possible, waste fluids generated from heavy equipment maintenance activities will be collected and removed from the site by the maintenance contractor for recycling. If waste fluids are required to be stored on site, they will be labeled accordingly, contained within Department of Transportation (DOT)-approved containers, and situated within a predesignated and properly designed hazardous waste container storage area. Containers of hazardous wastes containing free liquids have stringent secondary containment requirements.

These requirements include the following:

- The base will be free of cracks or gaps and sufficiently impervious to contain leaks, spills, and accumulated precipitation until the collected material is detected and removed.
- The base will be sloped or the containment system will be otherwise designed and operated to drain and remove liquids resulting from leaks, spills, or precipitation. Alternatively, the containers may be elevated on pallets to prevent contact with accumulated liquids.
- The containment system will have sufficient capacity to contain 10 percent of the volume of containers or the volume of the largest container, whichever is greater, plus the maximum rainfall from a 25-year, 24-hour storm event.
- Spilled or leaked waste and accumulated precipitation will be removed from the sump or collection area in a timely manner to prevent overflow of the collection system.

8.2.6 Container Labeling

Indelible ink will be used to label containers of potentially hazardous waste with a detailed description, including accumulation start date; and the words "Analysis Pending – Potentially Hazardous." A container log will be used to track contents, accumulation start data, sample identification number, sample date, and disposal date. If containers are determined to contain non-hazardous waste, they will be labeled accordingly. If containers are determined to contain hazardous waste, they will immediately be labeled with a completed "Hazardous Waste" label that will include:

- EPA identification number of the generator
- Name and address of the generator
- EPA waste code
- DOT shipping name (prior to off-site shipment)
- Description of contents
- Date of generation

An inventory of waste containers will be maintained. In addition, weekly inspections of container storage areas will be conducted and logged while wastes remain in these areas to ensure the integrity of the containers and secondary containment, to check for leaks or spills, and to ensure that labels and markings are in good condition.

8.2.7 Waste Accumulation Areas

TtEC and subcontractors working on this project will implement the following hazardous waste storage area requirements for waste stored on site:

- A sign with the legend, "Danger Hazardous Waste Area-Unauthorized Personnel Keep Out" (written in English and Spanish), will be posted at each waste accumulation area and stockpile in sufficient numbers to be seen from any approach. The signs will be legible from a distance of at least 25 feet.
- Aisle space will be maintained to allow for the unobstructed movement of personnel, fire-protection equipment, spill-control equipment, and decontamination equipment to any area of facility operation in an emergency, unless aisle space is not needed for any of these purposes.
- The following emergency equipment will be located or available to personnel during active waste management activities at each accumulation area:
  - A device, such as a telephone or a hand-held two-way radio, capable of summoning emergency assistance
  - Portable fire extinguishers, fire control equipment, spill control equipment, and decontamination equipment
  - Water at adequate volume and pressure to supply water hose streams, or foam-producing equipment, automatic sprinklers, or water spray systems
  - A spill-response kit for minor spills to include a shovel, adsorbent pads and/or "kitty litter," and a collection container

Bulk quantities of fuel, oil, or other hazardous material will not be stored on site. These materials will be managed by an off-site contractor who will, on an as-needed basis, perform equipment fueling and maintenance activities.

8.2.8 Waste Disposal

Hazardous wastes will be transported off site for appropriate recycling or disposal. Used PPE will generally be managed and disposed of as non-hazardous waste, unless work is required in areas of significant contamination. Other waste streams requiring off-site disposal will be sampled and analyzed, as necessary, to ensure that the waste is properly characterized and profiled and meets the waste-acceptance criteria and packaging requirements for the proposed treatment, storage, and disposal facility (TSDF) prior to transport.

Hazardous waste will be disposed of only at a hazardous waste disposal facility prequalified by TtEC and permitted for the disposal of the particular type of hazardous waste generated. Wastes disposed of off site will be sent to RCRA Subtitle C or RCRA Subtitle D facilities that meet the requirements of 40 CFR, Part 300.440 (CERCLA off-site policy).

8.2.9 Waste Transportation

Hazardous wastes sent off site for disposal or recycling will be done so in accordance with the DOT Hazardous Material Transportation regulations of 49 CFR, Parts 171–177, and 40 CFR, Part 262, Subpart B, and 22 CCR, Section 66262, which involves packaging, placarding, labeling, and manifesting requirements. Additionally, hazardous wastes will be sent off site for disposal or recycling with appropriate land disposal restriction (LDR) certification notices per 40 CFR, Part 268, and 22 CCR, Section 66268. Personnel having the required DOT training will perform all DOT functions. In addition, all transporter and disposal contractors will be subject to the subcontractor qualification process. Under no circumstances will TtEC personnel sign hazardous waste manifests.

If material is hazardous, it will be shipped under the appropriate hazard class. All hazardous waste will be transported under DOT hazardous material regulations. Each shipment of a suspected hazardous material will be properly classed using the Hazardous Material Table in 49 CFR, Part 172.101. DOT-trained personnel will make all determinations.

8.2.10 Waste Minimization

To minimize the volume of all waste streams generated during the project, the following general guidelines will be followed:

- Waste material will not be contaminated unnecessarily.
- Work will be planned ahead.
- Material may be stored in large containers, but the smallest reasonable container will be used to transport the material to the location where it is needed.
- Cleaning and extra sampling supplies will be maintained outside any potentially contaminated area to keep them clean and to minimize additional waste generation.

- Mixing of detergents or decontamination solutions will be performed outside potentially contaminated areas.
- Drop cloths or other absorbent material will be used to contain small spills or leaks.
- Contaminated material will not be placed with clean material.
- Wooden pallets inside the exclusion zone will be covered with plastic.
- Material and equipment will be decontaminated and reused when practicable.
- Volume reduction techniques will be used when practicable.
- Waste containers will be verified to ensure that they are solidly packed to minimize the number of containers.
- Only waste containers adequately sized to contain the volume of waste generated will be used.
- Less hazardous substances will be used whenever possible (only the volume of standard solutions needed for testing will be brought; minimal amounts of decontamination water and solvent rinses will be used).

8.2.11 Inspections

While all waste accumulation areas will be informally inspected on a daily basis, formal inspections of all container accumulation and stockpile areas will be conducted and recorded at least weekly in accordance with 40 CFR, Part 264, Subpart I, and 22 CCR, Section 66264. The Project Environmental and Safety Specialist (ESS) or designee will conduct inspections. Inspections will be recorded in a dedicated field logbook, and a weekly inspection checklist will be completed. The container storage area(s) will be inspected to ensure the following:

- The containers will be checked for good condition. If a container is not in good condition or appears to be leaking, the waste will be transferred to another container.
- All containers used will be checked to be sure that they are made of material that will not react with, and are otherwise compatible with, the hazardous waste to be stored.
- The containers will be checked to ensure that they remain closed at all times, except when adding or removing waste.
- The container label will be checked to ensure that it is filled out properly and to check the waste accumulation date.

Containers used for storage of collected runoff and decontamination water will be inspected on a daily basis and the inspections will be logged. The inspections will ensure that tanks have adequate secondary containment, are properly labeled, that they are in good condition (no apparent structural defects or deterioration), and have no visible leaks.

8.2.12 Documentation

Documentation requirements apply to all waste managed during project activities. Field records will be kept of all waste-generation activities. All pages of the field data record log will be signed and dated by the supervising field leader who is entering the data. In addition, the following information will be recorded in the log:

- Description of waste-generating activities
- Location of waste generation (including depth, if applicable)
- Type and volume of waste
- Date and time of generation
- Description of any waste sampling
- Name of person recording information
- Name of field manager at time of generation

8.2.13 Hazardous Waste Manifests and LDR Certification

Off-site transportation and disposal of hazardous wastes will be handled by the DON-selected waste contractor. All hazardous waste transported from the site will be accompanied by a hazardous waste manifest. DON personnel will be responsible for reviewing and signing all waste documentation, including waste profiles, manifests, and LDR notifications (manifest packages). Prior to signing the manifest, the designated DON official will ensure that pre-transport requirements of packaging, labeling, marking, and placarding are met according to 40 CFR, Parts 262.30–262.33, and 49 CFR, Parts 100–178.

8.3 WASTE MANAGEMENT FOR RADIOACTIVE WASTES

The following subsections address specific control and management practices for LLRW and LLMW, hereafter including low-level combined waste (LLCW). Disposal of all LLRW and LLMW will be handled through the DON's LLRW Disposal Program.

A certified waste broker contracted by the DoD Executive Agency for LLRW will be used for all packaging, shipping, manifesting, and disposal of LLRW and LLMW. The waste broker will coordinate closely with the RASO.

8.3.1 Waste Classification

Radioactive wastes will be classified as specified in 49 CFR and/or disposal facility requirements. These wastes will be categorized as either LLRW or LLMW. Waste characteristics, including the radionuclides present and their associated specific activity, will be measured by an available standardized test method such as gamma spectroscopy, strontium analysis, and/or alpha spectroscopy. Additionally, for LLMW, chemical waste characteristics can be measured by a standardized test method or be reasonably classified by generators of waste based on their knowledge of the waste, provided that the waste has already been reliably tested for acceptance at the waste disposal facility.

A waste determined not to be a RCRA LLMW may still be considered a state-regulated non-RCRA LLCW. The state is broader in scope in its RCRA program in determining hazardous waste. Relevant information pertaining to this requirement can be found in Section 8.2.1.

8.3.2 Waste Accumulation and Storage

As for hazardous waste, specific requirements apply to the accumulation time for LLMW on site and to the accumulation and labeling of LLMW. This project may result in the temporary accumulation of LLMW in containers. These wastes will be managed, accumulated, and inspected in accordance with the regulations. Accumulation time requirements do not apply to LLRW.

All LLRW and LLMW will be packaged per the direction of a waste broker certified by the DoD Executive Agency for LLRW (Army Joint Munitions Command) in accordance with federal directives and disposal facility requirements. Typical containers that may be used for these wastes include 55-gallon drums, B-25 boxes, and covered roll-off containers. Containers will be properly lined, and absorbent will be used if it is considered necessary. All containers will be surveyed and/or swiped when received. Each container will be properly inventoried and labeled. Inventories will include material description and isotopic identification, and hazardous components if appropriate. The contents of each container will be recorded in the field logbook, and each container will be assigned a unique identification number.

Containers will be stored in a designated and posted radioactive material storage area under the authority of TtEC's or the subcontractor's NRC license. Storage areas may be at the site where the waste originated or in Building 406 at HPS. Containers will be secured to prevent unauthorized access to their contents. Once filled, all containers will be surveyed and surface radiation measurements collected using an ion chamber survey meter or equivalent.

8.3.3 Soil, Debris, and Materials

Soil, debris, and materials classified as LLRW or LLMW may be generated during excavation. When classified as LLRW or LLMW, these wastes may be placed in 55-gallon drums, B-25 boxes, and/or roll-off containers. These containers will be managed as described in Section 8.3.2.

8.3.4 Wastewater and Waste Fluids

Wastewater from the radioactive material decontamination area will be maintained separately from hazardous decontamination and dewatering wastewater. If the wastewater chemical characteristics are unknown, wastewater will be managed as LLRW wastewater until characterized. Known or suspected LLMW wastewater will be segregated during accumulation and storage. When decontaminating and dewatering radioactively contaminated material, every effort should be made to minimize the generation of mixed waste.

8.3.5 Labeling and Posting of Containers Containing Radioactive Waste

Each waste container containing LLRW or LLMW will be labeled. The activity contained in each waste container will be reported in pCi/g and maximum contact radiation levels will be measured in milliroentgen per hour (mR/hr). Following the surveying and labeling, the waste container will be placed in a designated and posted radioactive material storage area. The waste container will be posted with a "Caution – Radioactive Material" sign. The sign will also note the maximum surface radiation level (measured in mR/hr). An inventory of contents with radionuclide and specific activity (if available) will be posted on the outside of the container or a notice will be posted stating where this information is found. LLMW will also be marked in accordance with the requirements in Section 8.2.6. The waste inventories will be managed under the appropriate NRC license, including the mixed waste inventory due to the radioactive constituents.

8.3.6 Waste Accumulation Areas

TtEC and subcontractors working on this project will implement, at a minimum, the following requirements for radioactive waste stored on site within a designated radioactive waste storage area:

- The display of industry standard placard and barrier materials with wording that includes the following, "Caution, Radioactive Materials Area-Unauthorized Personnel Keep Out" (written in English and Spanish), at each radioactive waste storage area sufficient to be seen from any approach. The signs will be legible and clearly conspicuous for outdoor and indoor locations.
- Aisle space will be maintained to allow for the unobstructed movement of personnel, fire-protection equipment, spill-control equipment, and decontamination equipment to any area of facility operation in an emergency, unless aisle space is not needed for any of these purposes.
- The areas will be secured to prevent unauthorized access to the material.
- The following emergency equipment will be located or available to personnel during radioactive waste management activities at each accumulation area:
  - A device, such as a telephone or a hand-held two-way radio, capable of summoning emergency assistance.
  - Portable fire extinguishers, fire-control equipment, spill-control equipment, and decontamination equipment.

Filled containers generated during performance of this Work Plan will be stored at the site where they were generated or may be placed in Building 406 or in other RASO-approved storage locations until the contained material can be characterized for packaging and disposal by the waste broker.

8.3.7 Waste Disposal

A certified waste broker contracted by the DoD Executive Agency for LLRW will be used for all packaging, shipping, manifesting, transportation, and disposal of LLRW and LLMW. The certified waste broker will coordinate closely with RASO. LLRW and LLMW inventories will be managed under the appropriate NRC license due to the radioactive constituents.

The certified waste broker will be responsible for preparing the hazardous waste manifests for the LLMW and the radioactive waste manifests for the LLRW. LLRW manifests will be signed by the certified waste broker or the DON as appropriate. LLMW manifests are signed by the CSO. The certified waste broker will also be responsible for coordinating the shipment of LLMW and LLRW and coordinating with the waste-disposal facilities.

8.3.8 Waste Transportation

Wastes sent off site for disposal will be done so in accordance with the DOT Radioactive Material Transportation regulations of 49 CFR, by a certified waste broker contracted by the DoD Executive Agency for LLRW. Personnel having the required DOT training will perform assistance as needed.

The certified waste broker will be responsible for surveying and taking radiation measurements on the outside of the container prior to shipment. The certified waste broker will work with the RTM to ensure that empty containers being returned to vendors meet the release limits for equipment and materials identified in Table 4-3.

8.3.9 Waste Minimization

To minimize the volume of radioactive waste generated during the project, the following general guidelines will be followed:

- Waste material will not be contaminated unnecessarily.
- Work will be planned ahead.
- Cleaning and extra sampling supplies will be maintained outside any potentially contaminated area to keep them clean and to minimize additional waste generation.
- Mixing of detergents or decontamination solutions will be performed outside potentially contaminated areas.
- When decontaminating radioactively contaminated material, every effort should be made to minimize the generation of mixed waste.
- Contaminated material will not be placed with clean material.

- Wooden pallets inside the exclusion zone will be covered with plastic.
- Material and equipment will be decontaminated and reused when practicable.
- Volume reduction techniques will be used when practicable.

8.3.10 Inspections

While all waste accumulation areas will be informally inspected on a daily basis, formal inspections of all container accumulation areas will be conducted and recorded at least weekly in accordance with the appropriate NRC license requirements. The RTM or designee will conduct inspections that will be recorded in a dedicated field logbook, and a weekly inspection checklist will be completed. The container storage area(s) will be inspected to ensure the following:

- The containers will be checked for good condition. If a container is not in good condition the certified waste broker will be informed.
- The containers will be checked to ensure that they remain closed and secured at all times, except when adding or removing waste.
- The container label will be checked to ensure that it is visible and filled out properly.

8.3.11 Documentation

Documentation requirements apply to all waste managed during project activities. Field records will be kept of all waste-generation activities. All pages of the field data record log will be signed and dated by the person entering the data. In addition, the following information will be recorded in the log:

- Description of waste-generating activities
- Location of waste generation (including depth, if applicable)
- Type and volume of waste
- Date and time of generation
- Description of any waste sampling
- Name of person recording information
- Name of RTM at time of generation

8.3.12 Radioactive Waste Manifests

All radioactive waste transported from the site will be accompanied by a radioactive waste manifest and/or hazardous waste manifest as appropriate. The LLRW/LLMW manifests are the responsibility of the certified waste broker. LLRW manifests are signed by the broker.

The CSO and RASO will each receive one copy of the manifest; the remaining copies will be given to the transporter. The manifest will be returned to the DON's signatory official for the base's recordkeeping requirements.

8.4 UPDATING THE WASTE MANAGEMENT PLAN

The WMP will be updated as changes in site activities or conditions or changes in applicable regulations occur. Revisions to the WMP will be reviewed and approved by the DON. All changes to the WMP associated with radioactive or mixed waste will require approval from RASO.

9.0 ENVIRONMENTAL PROTECTION PLAN

This EPP presents information regarding the environmental management program for the base-wide sanitary and storm drain system radiological characterization and remediation. The purpose of this EPP is to detail the means of compliance with the applicable or relevant and appropriate environmental regulatory requirements for the remediation effort. This EPP will help ensure that activities associated with the environmental management program are conducted in a systematic and well-documented manner. The EPP includes environmental compliance procedures and regulatory, procedural, and training requirements associated with conducting the field activities. The TtEC PjM's responsibility is to verify that all project personnel are aware of the compliance requirements of this plan.

9.1 EXISTING NATURAL RESOURCES

Project activities will be conducted throughout all of HPS. Although the majority of the sanitary and storm drain lines are located in developed areas, work may be conducted adjacent to tidal wetlands along the shoreline. Each discrete wetland is less then 5 acres in size, has low-vegetative diversity classifications, potentially toxic inputs, and is small and discontinuous in nature (Levine-Fricke-Recon, Inc., and PRC Environmental Management, Inc. [PRC], 1997; Tetra Tech EM, Inc. [TtEMI], 2003). These wetland/habitat features provide low-quality habitat and little opportunity for wildlife breeding.

The climate in the San Francisco Bay area is temperate and influenced by the regional topography and proximity to the Pacific Ocean. Fairly constant and predictable, the climate has a bimodal seasonal pattern with respect to temperature and rainfall. Summers are usually warm and dry, with the exception of morning and evening fog due to a marine inversion layer. Winters are wet and cool with most annual precipitation occurring between October and March.

Parcel-specific design plans will identify wetland areas within the parcel. When storm drain and sewer removal activities disturb these areas, a Wetlands Mitigation Plan will be developed to assure no net loss of wetlands area.

9.2 DESCRIPTION OF HABITAT AND SENSITIVE SPECIES

San Francisco Bay coastal open water, tidal channels, and wetlands are adjacent to the project area and within its associated 1,000-foot zone of influence (ZOI). While numerous species of plants, wildlife, and other biota have been observed at or near the project area and its associated ZOI, no federally listed or candidate species are known to permanently reside or regularly breed within the project impact area or ZOI (Levine-Fricke-Recon, Inc. and PRC, 1997; TtEMI, 2002; California Department of Fish and Game [CDFG], 2003).

The majority of the projected work activities will be conducted in developed areas that provide little potential habitat for either plants or animals. There are no known sensitive species.

The upland habitat is composed of ruderal upland species and relatively flat topography. Surface elevations of adjacent land are generally less than 10 feet above msl.

In general, existing vegetation within the near shore area is sparse. Portions of the near shore area are adjacent to intertidal areas. These wetland/habitat features provide low-quality habitat and little opportunity for wildlife breeding. The dominant vegetation in all wetland areas is common pickleweed (*Salicornia virginica*) and salt grass (*Distichillis spicata*), while the uplands have a predominance of fennel (*Foeniculum vulgare*), black mustard (*Brassica nigra*), barley (*Hordeum murinum*), cultivated oat (*Avena sativa*), plantain (*Plantago* sp.), and perennial rye grass (*Lolium perene*). Habitats within the project area are composed of disturbed upland species.

The California Natural Diversity Database maintained by the CDFG has no published records of special-status species within the proposed project's direct impact area and ZOI. These findings are consistent with previous site-specific surveys, which have investigated HPS for the presence of special-status plants and wildlife species (Levine-Fricke-Recon, Inc. and PRC, 1997; TtEMI, 2002; CDFG, 2003; TtFW, 2004). Table 8-1 lists the threatened and endangered species at or near HPS.

9.3 RUN-ON AND RUNOFF CONTROL PROVISIONS

The SWPPP is included as Appendix C. The SWPPP addresses run-on and runoff control measures and other BMPs that will be implemented during field activities to prevent the migration of potentially contaminated soil and sediment.

9.4 REGULATORY REQUIREMENTS

Based on the analysis in the Final AM (DON, 2006), the DON recommended a removal action for potentially radioactive material associated with base sanitary sewer and stormwater lines that includes excavation and off-site disposal. This alternative was recommended because it best meets the NCP criteria of overall protectiveness of human health; compliance with ARARs; long-term effectiveness; reduction of mobility, toxicity, or volume through treatment; short-term effectiveness; implementability; cost; and state and community acceptance. Implementation requires that soils above the cleanup levels for the ROCs be excavated, stockpiled, and transported off site to an appropriately permitted TSDF. Additionally, soils within IR site areas will be stockpiled and sampled separately for chemical contamination. Prior to the start of work, the DTSC and WB will be notified of the intent to begin cleanup. A complete discussion of ARARs and evaluation of potential ARARs is presented in the AM (DON, 2006).

9.4.1 Specific Environmental/Regulatory Requirements

Environmental/regulatory requirements applicable to the base-wide sanitary and storm drain system radiological characterization and remediation are described below.

9.4.1.1 Hazardous Waste Management

Excavated soils and waste material classified as potentially TSCA or hazardous waste will be temporarily staged on a 20-mil HDPE or PVC liner pending off-site disposal. Wastes staged on site will be protected from run-on and runoff and will be covered to prevent wind dispersion. HPS has an EPA generator identification number that will be used on the manifests that accompany each hazardous waste shipment.

9.4.1.2 Air Emissions

The substantive requirements of the BAAQMD rules relating to visible emissions, fugitive dust, and particulate matter emissions must be complied with; however, no permits are required. A grading permit is also not required, as the federal government is exempt under county ordinance, provided grading is supervised and inspected by a registered professional engineer.

9.4.1.3 Stormwater Pollution Prevention Plan

A SWPPP (Appendix C), which addresses installation and maintenance of appropriate BMPs for controlling stormwater, has been prepared in accordance with SWRCB requirements; however, a general NPDES stormwater construction permit will not be required. Because the field activities are regulated under CERCLA, only the substantive requirements of the NPDES permit apply.

9.4.1.4 Base Approvals

TtEC will coordinate with the CSO, RASO, and the RPM to obtain necessary station approvals for the excavation of impacted soil. Required approvals may include underground utility clearance and selection of the analytical laboratory and off-site disposal facilities.

9.4.2 Excavation Activities

Excavation activities will be performed in accordance with pertinent regulatory requirements. The applicable regulations, along with the methods to assure compliance with these regulations, are described below.

9.4.2.1 Excavation Management Plan

Unstable earth conditions are not expected during the removal activities. Soil within the limits of excavation will be excavated in approximate 100-foot sections in order for these sections to be shored and covered until released. Daily inspections of excavations will be performed by a competent person to assess the stability of the slopes and excavated area. Any excavation deeper than 5 feet will require that notification be given to Cal-OSHA, per the current excavation permit acquired by TtEC on an annual basis. Received excavation permits will be posted. OSHA excavation regulations and permits will be followed at all times. Excavation activities will be conducted in accordance with the requirements within CCR Title 8, Sections 1539–1541, and Title 29 CFR, Parts 1910 and 1926.

9.4.2.2 Fugitive Dust

Fugitive dust emissions may occur during soil excavation and waste-handling activities. All construction activities will comply with the substantive requirements of BAAQMD Rule 40 and Regulations 6-305 and 8 pertaining to fugitive dust emissions and maintaining, covering, and stockpiling excavated soil. Dust will be controlled during excavation with water application. Ambient air monitoring for dust, including potential airborne radioactivity, will be performed upwind and downwind of the project area per the SHSP (TtEC, 2006) and the associated RWP. The monitoring results will be used to determine if additional measures are required to control adverse impacts from airborne contaminants. Measures may include increased PPE levels for project personnel, reduction or stopping of excavation activities, and/or dust abatement using water application or by covering stockpiles with plastic sheets.

9.4.2.3 Floodplains and Wetlands

The excavation activities are not located within a 100-year floodplain defined by the U.S. Geologic Survey. Limited shoreline areas have wetlands; however, these areas are not expected to be impacted by site activities. Therefore, requirements pertaining to floodplain and wetlands protection are not applicable because those features are being avoided.

9.4.2.4 Endangered Species and Migratory Birds

No federally listed species are known to permanently reside on or in the vicinity of HPS (Levine-Fricke-Recon, Inc. and PRC, 1997); however, San Francisco Bay is a seasonal home for birds migrating along the Pacific Flyway, and numerous species of migratory birds have been observed at HPS. Disturbance of habitats will be restricted to only those areas necessary for site mobilization and setup and locations where work is being performed. No work is currently planned or anticipated during the fish window. To comply with the substantive provisions of the action-specific ARARs identified for HPS activities, the DON will implement avoidance and minimization measures.

9.4.2.5 Worker Health and Safety

Field activities will be governed by TtEC's SHSP (TtEC, 2006), RWPs, and New World Technology's NRC license.

All activities will be performed in accordance with OSHA requirements for worker safety. The SHSP (TtEC, 2006) provides requirements and guidelines that will be used in the field to protect the health and safety of workers. An SHSS will provide full-time oversight of activities to ensure compliance with OSHA regulations and the SHSP (TtEC, 2006). In parallel, qualified RCTs will provide continuous oversight of work area operations to ensure compliance with the occupational and environmental standards and practices defined in NWT's radioactive materials license and subject to enforcement by the NRC.

9.5 RELEASE PREVENTION, RESPONSE, AND REPORTING

9.5.1 Spill Prevention

The primary activities that may result in a spill include vehicle fueling and management of decontamination waste. Spill prevention practices for these activities are as follows:

- **Fueling** – All vehicles will be fueled and serviced prior to moving onto the site. Any on-site fueling of equipment will be conducted within a designated and controlled area. No bulk quantities of fuel will be stored on site.
- **Wastewater** – Wastewater will be stored in double-walled temporary tanks or 55-gallon drums within a secondary containment area. Therefore, any spills from the containers or tanks will be contained and will not be released into the surrounding areas.

9.5.2 Spill Response

In the event of a release of hazardous material into the environment, per the SHSP (TtEC, 2006), TtEC will contain or control the release or evacuate the area if the spill is significant or represents an immediate health threat. Spills, leaks, and fires at HPS must be reported to the RPM, ROICC, and CSO. In addition, all spills involving radioactive material must be reported to the RSO and RASO. Absorbent pads, shovels, and 55-gallon drums will be kept on site to address the possibility of spills.

9.5.3 Spill/Release Reporting

The steps below outline the chain of communications that will be followed if a significant spill of any hazardous substance occurs. A significant spill will be considered any spill over the reportable quantity, as determinable by federal and/or state regulations, as well as any spill below the reportable quantity not properly contained and released into the environment.

1. Site personnel involved in the spill will immediately contact the TtEC Spill/Release On-site Coordinator, Site Superintendent, or SHSS, who will notify the PjM and the Project Environmental and Safety Manager (PESM). At least one of the following two individuals will be on site during all remedial activities:

SHSS:	To be Determined
On-site Coordinator and Construction Manager:	Gary Clark
Site Superintendent	Jeff Bray

   The TtEC SHSS or Site Superintendent will contact the RPM, ROICC, CSO, and RASO individuals identified below:

RPM:	Ralph Pearce (619) 532-0912
ROICC:	Peter Stroganoff (510) 759-5941
CSO:	Mike Mentink (415) 743-4729
RASO	Laurie Lowman (757) 887-4692

2. If a release of a waste or hazardous substance, regardless of quantity, could threaten human health or the environment outside the facility, the PjM will verify that the National Response Center (800-424-8802) and the local Emergency Response Coordinator (Fire Department) have been notified by the DON. Releases will be reported, and written follow-up emergency notices will be submitted under the Superfund Amendments and Reauthorization Act, Title II requirements.

3. In concert with the above actions, the following persons will be contacted by the PjM or Site Superintendent:

TtEC Regulatory Compliance Specialist:	Jennifer Kinney
TtEC CIH/PESM:	Roger Margotto

In the event of a spill of radioactive material, TtEC will make appropriate notifications in accordance with its NRC license requirements. Notifications will also include the DON RPM, RASO, and the subcontractor.

9.6 PROJECT AND PERSONNEL REQUIREMENTS

TtEC personnel training requirements and inspection programs are described below. Protocols for inspections by regulatory agencies and third parties are also addressed below.

9.6.1 Personnel Training/Certification Requirements

Project personnel training/certification requirements are as follows:

- OSHA 40-hour Hazardous Waste Operations and Emergency Response and annual 8-hour refresher training.
- Radiation awareness training.
- RWP and Task-specific Plan training for the specific site or task.
- AHA training for the specific task.
- SHSP training, as required.
- Site personnel performing DOT functions, such as selecting, packaging, marking, labeling, preparing shipping papers for, and loading non-radiological wastes, must be trained in accordance with the requirements of DOT course HM-126F.
- Project personnel performing non-radiological waste management activities must be certified under TtEC's waste management training in accordance with Title 40 CFR, Parts 262.11 through 265.16.
- Personnel handling/storing radioactive material will be trained in accordance with TtEC's NRC license requirements.
- Only waste brokers certified by DoD Executive Agency (Army Joint Munitions Command, Rock Island) will ship LLRW and LLMW.

All project personnel (TtEC and subcontractors) will be trained according to TtEC's compliance policies and procedures, including TtEC's Radiological Protection Program, or equivalent. TtEC's personnel records will be verified along with the subcontractors' training records prior to beginning project activities.

Project-specific training/certification records will be kept on site until project completion. At project completion, the records will be filed within the project files.

9.6.2 Inspection and Audit Procedures

Site inspections and audits may occur during the removal activities to ensure compliance with applicable state and federal regulations and the SHSP (TtEC, 2006).

9.6.2.1 Inspections by the TtEC Personnel

TtEC inspections will be conducted regularly to document compliance with environmental health and safety regulations and TtEC's procedures. The inspection requirements are documented within this Work Plan, TtEC's company procedures, and in the SHSP (TtEC, 2006).

9.6.2.2 Inspections by Regulatory Agencies

Regulatory inspections will be handled by TtEC in accordance with TtEC's compliance procedure for environmental inspections by regulatory agencies. These procedures require that, in addition to contacting the RPM and CSO, project personnel or the PjM must notify the TtEC Regulatory Compliance Specialist. Specific NRC license inspections will be handled by the license holder.

9.6.2.3 Designated Representative for Inspections by Regulatory Agencies

TtEC is the designated on-site representative for inspections by regulatory agencies.

Any non-regulatory third party requesting access to inspect the site must be referred to the DON for access. TtEC personnel or their subcontractors must not grant site access or answer questions for unauthorized personnel. TtEC will notify the RPM and CSO of any attempts to gain site access by third parties.

Members of the media asking questions or attempting to access the project area will be referred to the RPM.

9.7 DOCUMENTATION AND RECORDS RETENTION

Documentation of regulatory compliance issues and records retention will be conducted in accordance with the TtEC compliance procedures for documentation and records retention and *Installation Restoration Manual 2001* (DON, 2001).

Under contract conditions, documents must be kept in the project files for a minimum of 10 years. In addition, compliance records will be maintained in accordance with the compliance procedure for documentation and records retention.

9.8 UPDATING THE EPP

This EPP will be updated as needed to reflect changing site conditions.

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TABLES

TABLE 3-1

RADIOLOGICAL REMEDIAL OBJECTIVES

Radionuclide	Soil[a] (pCi/g)		Water[a] (pCi/L)[*]
	Residential	Outdoor Worker	
Cesium-137	0.113	0.113	119
Radium-226	1.0[b]	1.0[b]	5.0
Strontium-90	0.331	10.8	8

Notes:

[a] The on-site and off-site laboratory will ensure that the MDA meets the listed release criteria by increasing sample size or counting time as necessary. The MDA is defined as the lowest net response level, in counts, that can be seen with a fixed level of certainty, customarily 95 percent. The MDA is calculated per sample by considering background counts, amount of sample used, and counting time.

[b] Limit is 1 pCi/g above background per agreement with EPA.

* Release criteria for water have been derived from *Radionuclides Notice of Data Availability Technical Document* (EPA, 2000) by comparing the limits from two criteria and using the most conservative limit.

Abbreviations and Acronyms:

EPA – U.S. Environmental Protection Agency
MDA – minimum detectable activity
pCi/g – picocurie per gram
pCi/L – picocurie per liter

TABLE 3-2

SUMMARY OF POTENTIAL CHEMICAL-SPECIFIC ARARS

Type/Name of Potential ARAR	Citation	Description and Comments	Potentially Applicable or Relevant and Appropriate
RCRA	42 USC 6901 et seq. 40 CFR 240-271	RCRA establishes standards for the generation, management, and disposal of solid and hazardous waste. RCRA is relevant and appropriate in that solid wastes generated from remedial actions at the site may result in the generation and disposal of solid or hazardous waste subject to RCRA requirements.	Relevant and Appropriate
Standards Applicable to Generators of Hazardous Waste	22 CCR 66262.10 et seq.	These standards are applicable to all generators of hazardous waste in the state of California and are implemented by the Division of Toxic Substances Control. Generators are required to obtain an EPA identification number and to adequately characterize wastes to determine if they are hazardous.	Applicable

Abbreviations and Acronyms:

ARAR – applicable or relevant and appropriate requirement
CCR – California Code of Regulations
CFR – Code of Federal Regulations
EPA – U.S. Environmental Protection Agency
RCRA – Resource Conservation and Recovery Act
USC – United States Code

TABLE 3-3

SUMMARY OF POTENTIAL LOCATION-SPECIFIC ARARS

Type/Name of Potential ARAR	Citation	Description and Comments	Potentially Applicable or Relevant and Appropriate
CWA	33 USC 1344 et seq., Section 404	The CWA regulates the discharge of non-toxic and toxic pollutants by specific and non-specific sources. Section 404 specifically regulates dredging and discharging of fill material to waterways. Permits are required as part of the Section 404 requirements; however, because the project is being completed under CERCLA authority, a permit is not necessary. The substantive aspects of the permit will be followed.	Relevant and Appropriate
Executive Order No. 11990, Protection of Wetlands	Executive Order No. 11990	This presidential order mandates that agencies shall take action to minimize the destruction, loss, or degradation of wetlands. Site activities will not occur in designated wetlands. Wetlands located outside of the remediation area will remain unaffected by site activities.	Relevant and Appropriate
Porter-Cologne Water Quality Control Act, as administered by the SWRCB and the WB, San Francisco Bay Region	California Water Code, Division 7, Section 13000	This act defines legislative intent to attain the highest water quality reasonable considering the demands on the resource. It applies to all groundwater and soil remediation projects where groundwater protection is an issue. This is applicable to the extent that groundwater will not be degraded as a result of the actions taken to remove radioactive sources from the site.	Applicable
San Francisco Bay Water Quality Control Plan (Basin Plan; 1995)	Basin Plan	This plan defines beneficial uses for groundwater, wetlands, and surface waters (including San Francisco Bay) throughout the Basin.	Applicable
Endangered Species Act	16 USC 1531-1543	The Endangered Species Act protects listed species and their habitat in the area of the proposed remedial action. To the extent such species are present at the site, this requirement is potentially applicable.	Relevant and Appropriate

TABLE 3-3

SUMMARY OF POTENTIAL LOCATION-SPECIFIC ARARS

Type/Name of Potential ARAR	Citation	Description and Comments	Potentially Applicable or Relevant and Appropriate
Coastal Zone Management Act	16 USC 1451 -1464	This act requires federal agencies conducting or supporting activities directly affecting the coastal zone to ensure that such activities are consistent with the state program. "Coastal Zone" is defined as the "coastal waters…and the adjacent shore lands (including the waters therein and hereunder) strongly influenced by each other and in proximity to the shorelines of several coastal states, and includes islands, transitional and intertidal areas, salt marshes, wetlands, and beaches…The zone extends inland from the shorelines only to the extent necessary to control shore lands, the uses of which have a direct and significant impact on the coastal water."	Relevant and Appropriate

Abbreviations and Acronyms:

ARAR – applicable or relevant and appropriate requirement
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
CWA – Clean Water Act
SWRCB – State Water Resources Control Board
USC – United States Code
– California Water Board

TABLE 3-4

SUMMARY OF POTENTIAL ACTION-SPECIFIC ARARS

Type/Name of Potential ARAR	Citation	Description and Comments	Potentially Applicable or Relevant and Appropriate
BAAQMD Regulations under the CAA	BAAQMD Regulations 6-301, 6-302, and 6-305	Regulation 6 – Particulate Matter and Visible Emissions discusses standards and limitations for emissions of PM_{10}. Emissions are not permitted to leave the boundary of the site. Due to the nature of operations, it is anticipated that emissions could potentially occur; therefore, mitigation measures will be implemented. These will include frequent watering of dirt roads and misting of areas where emissions might be expected to occur. Additionally, a Dust Control Plan will be implemented.	Applicable
California Air Resources Board Asbestos Airborne Toxic Control Measures for Construction, Grading, Quarrying, and Surface Mining Operations	BAAQMD Regulation 11, Rule 15	This regulation defines specific requirements and site controls that need to be met where grading may occur. An Asbestos Dust Mitigation Plan will be prepared to document the measures that will be taken to prevent airborne exposure to asbestos fibers resulting from the disturbance of serpentine-containing soils.	Applicable
RCRA AOC Policy	55 Federal Register 8758-8760	The preamble to the NCP discusses the AOC policy. EPA interprets RCRA to allow certain discrete areas of contamination to be considered RCRA units. Because of this, consolidation of hazardous waste within the AOC does not create a new point of hazardous waste generation for purposes of RCRA. All wastes will be managed within the AOC to allow for reconsolidation following radioactive source screening.	Applicable

TABLE 3-4

SUMMARY OF POTENTIAL ACTION-SPECIFIC ARARS

Type/Name of Potential ARAR	Citation	Description and Comments	Potentially Applicable or Relevant and Appropriate
RCRA Land Disposal Restrictions	22 CCR 66268.7 et seq.	This regulation describes standards applicable to the disposal of hazardous waste on land. It is applicable because RCRA-hazardous wastes may be disposed of off site, requiring LDRs. Notifications will be prepared for all RCRA-regulated wastes. Soils, which are screened for radioactive materials and returned to the excavations, will not trigger the LDR requirements, as they will be managed under the AOC policy.	Applicable
Staging Piles	40 CFR 264.554	Staging piles may be used on site for temporary accumulation of non-flowable hazardous wastes. Wastes will not be treated while in the pile and may be stored for up to 2 years. This regulation will allow for temporary waste storage that will not trigger LDR requirements.	Applicable
DTSC Hazardous Waste Transportation	22 CCR 262.20-23 22 CCR 262.30-33	These regulations provide specifics for manifest usage during hazardous waste transportation. Additionally, they mandate compliance with DOT regulations for packaging, labeling, marking, and placarding.	Applicable
NPDES Permit as managed by the SWRCB	Order 99-08	The State of California implements the CWA by requiring permits for discharges to navigable waters. It is expected that a NPDES General Permit for Construction Activities will be required. A Stormwater NPDES General Permit requires the implementation of Best Management Practices, implementation of an SWPPP, implementation of a stormwater monitoring program, and the elimination of non-stormwater discharges.	Applicable

TABLE 3-4

SUMMARY OF POTENTIAL ACTION-SPECIFIC ARARS

Type/Name of Potential ARAR	Citation	Description and Comments	Potentially Applicable or Relevant and Appropriate
DOT Hazardous Material Regulations	49 CFR 171 and 172	These regulations specify requirements for packaging, labeling, marking, manifesting, placarding, and safe transport of hazardous materials (including hazardous waste). All requirements will be adhered to and DOT-trained personnel will perform DOT functions.	Applicable
Storage and Control of Licensed Material	10 CFR 20.1801	This regulation requires the securing of radioactive materials to prevent unauthorized access by unauthorized persons. Radioactive wastes will be secured to prevent unauthorized access prior to transport off site.	Applicable

Abbreviations and Acronyms:

AOC – Area of Contamination
ARAR – applicable or relevant and appropriate requirement
BAAQMD – Bay Area Air Quality Management District
CAA – Clean Air Act
CCR – California Code of Regulations
CFR – Code of Federal Regulations
CWA – Clean Water Act
DOT – Department of Transportation
DTSC – Department of Toxic Substances Control
EPA – U.S. Environmental Protection Agency
LDR – land disposal restriction
NCP – National Oil and Hazardous Substances Pollution Contingency Plan
NPDES – National Pollutant Discharge Elimination System
PM_{10} – particulate matter less than 10 microns in diameter
RCRA – Resource Conservation and Recovery Act
SWPPP – Stormwater Pollution Prevention Plan
SWRCB – State Water Resources Control Board

TABLE 4-1

INSTRUMENTATION FOR RADIOLOGICAL SURVEYS

Measurement/ Technique	Primary Use	Type of Instrumentation: Detector Type and Ludlum Model Number(s)	Type of Instrumentation: Meter Description and Ludlum Model Number(s)	Typical Background	Typical Total Efficiency (%)	Detection Sensitivity	Typical Minimum Detectable Concentration
Surface alpha/beta scans	Equipment, materials, and debris	Large-area gas - proportional 43-68 ($126\ cm^2$)	Data logger 2350-1, 2360	150-250 cpm β 0-2 cpm α	~6 β total efficiency ~6 α total efficiency	900 dpm/100 cm^2 β 100 dpm/100 cm^2 α	553 dpm/ 100 cm^2 β 53 dpm/ 100 cm^2 α
Direct measurement static alpha/beta		Scintillation, Ludlum Model 43-89 ($100\ cm^2$)		100-200 cpm β 0-5 cpm α			
Surface gamma scans	Equipment, materials, debris and trenches	NaI 2-inch x 2-inch scintillation Ludlum Model 44-10	Data logger 2350-1	5,000 cpm γ	N/A	1,500 cpm γ 1.6 pCi/g ^{137}Cs 1.34 pCi/g ^{226}Ra	353 cpm γ
Direct measurement static gamma	Trenches and excavated soil						
Towed array surface gamma scans	Excavated Soil	(12) NaI 2-inch x 2-inch scintillation Ludlum Model 44-10	Data logger 4612	5,000 cpm γ	N/A	1.6 pCi/g ^{137}Cs 0.58 pCi/g ^{226}Ra	353 cpm γ
Surface beta/gamma scans	Equipment, materials, debris, and personnel	Geiger-Mueller Ludlum Model 44-9	Ratemeter 3	50 to 100 cpm $\beta\ \gamma$	~10 $\beta\ \gamma$ total efficiency	~ 1,000 dpm per probe area $\beta\ \gamma$	358 dpm/100 cm^2 $\beta\ \gamma$
Direct measurement static beta/gamma	Equipment, materials, debris, and personnel						
Exposure rates	All inclusive	MicroR Meter with integral 1-inch x 1-inch NaI scintillation	Ratemeter 19	7-8 μR/hr	N/A	2 μR/hr	N/A

TABLE 4-1

INSTRUMENTATION FOR RADIOLOGICAL SURVEYS

Abbreviations and Acronyms:

α – alpha
β – beta
γ – gamma
μR/hr – microroentgen per hour
cm^2 – square centimeters
cpm – counts per minute
^{137}Cs – cesium-137
dpm – disintegrations per minute
N/A – not applicable
NaI – sodium iodide
pCi/g – picocurie per gram
^{226}Ra – radium-226

TABLE 4-2

ON-SITE LABORATORY INSTRUMENTATION

<table>
<tr><th colspan="5">Laboratory Instruments</th></tr>
<tr><th>Measurement/ Technique</th><th>Type of Instrumentation*</th><th>Typical Background</th><th>Typical Efficiency (%)</th><th>Detection Sensitivity</th></tr>
<tr><td>Gamma spectroscopy</td><td>High-purity Germanium Detector</td><td>N/A</td><td>N/A</td><td>0.05 pCi/g (for ^{137}Cs)
0.5 pCi/g (for ^{226}Ra)</td></tr>
<tr><td>Gross alpha and beta/gamma on swipes (swipes)</td><td>Protean IPC9025 low-background gas-flow proportional counter</td><td>1-5 cpm β
0-0.5 cpm α</td><td>~62 β
~27 α</td><td>4-10 dpm/100 cm^2 β
2-5 dpm/100 cm^2 α</td></tr>
<tr><td>^{90}Sr Analysis</td><td>Protean low-background gas-flow proportional counter</td><td rowspan="2">N/A</td><td>~30% ^{90}y
~30% ^{90}Sr</td><td>0.070 pCi/g</td></tr>
<tr><td>Alpha Spectroscopy</td><td>Octec 8 chamber analyzer</td><td>~30% α</td><td>0.020 pCi/g</td></tr>
</table>

Notes:

* or equivalent

Types of radiation: α - alpha, β - beta

Abbreviations and Acronyms:

cm^2 – square centimeters
cpm – count per minute
^{137}Cs– cesium-137
dpm – disintegration per minute
N/A – not applicable
pCi/g – picocurie per gram
^{226}Ra – radium-226
RRO – radiological remedial objective
^{90}Sr – strontium-90
^{90}y – yitrium-90

TABLE 4-3

EQUIPMENT AND MATERIALS RELEASE CRITERIA

Contaminant	Removable[a] (dpm/100 cm^2)	Total[a] (dpm/100 cm^2)
Radium-226	20 α	100 α
Cesium-137	1000 β^-, γ	5,000 β^-, γ
Strontium-90	200 β^-	1,000 β^-

Notes:

[a] These limits are for the release of equipment and materials and are based on *Regulatory Guide 1.86* (Atomic Energy Commission, 1974).

Types of radiation: α – alpha, γ – gamma, β^- – beta

Abbreviations and Acronyms:

cm^2 – square centimeters
dpm – disintegration per minute

TABLE 4-4

DERIVED AIRBORNE CONCENTRATIONS

Radionuclide	Worker	
	DAC (μCi/mL)	**10% DAC (μCi/mL)**
Radium-226	3.0E-10	3.0E-11
Strontium-90	2.0E-9	2.0E-10
Cesium-137	6.0E-8	6.0E-9

Notes:

The above guideline values were determined using the NRC's 10 CFR, Part 20, Appendix B.

Abbreviations and Acronyms:

μCi/mL – microcuries per milliliter (activity)
CFR – Code of Federal Regulations
DAC – derived airborne concentration
NRC – Nuclear Regulatory Commission

TABLE 8-1

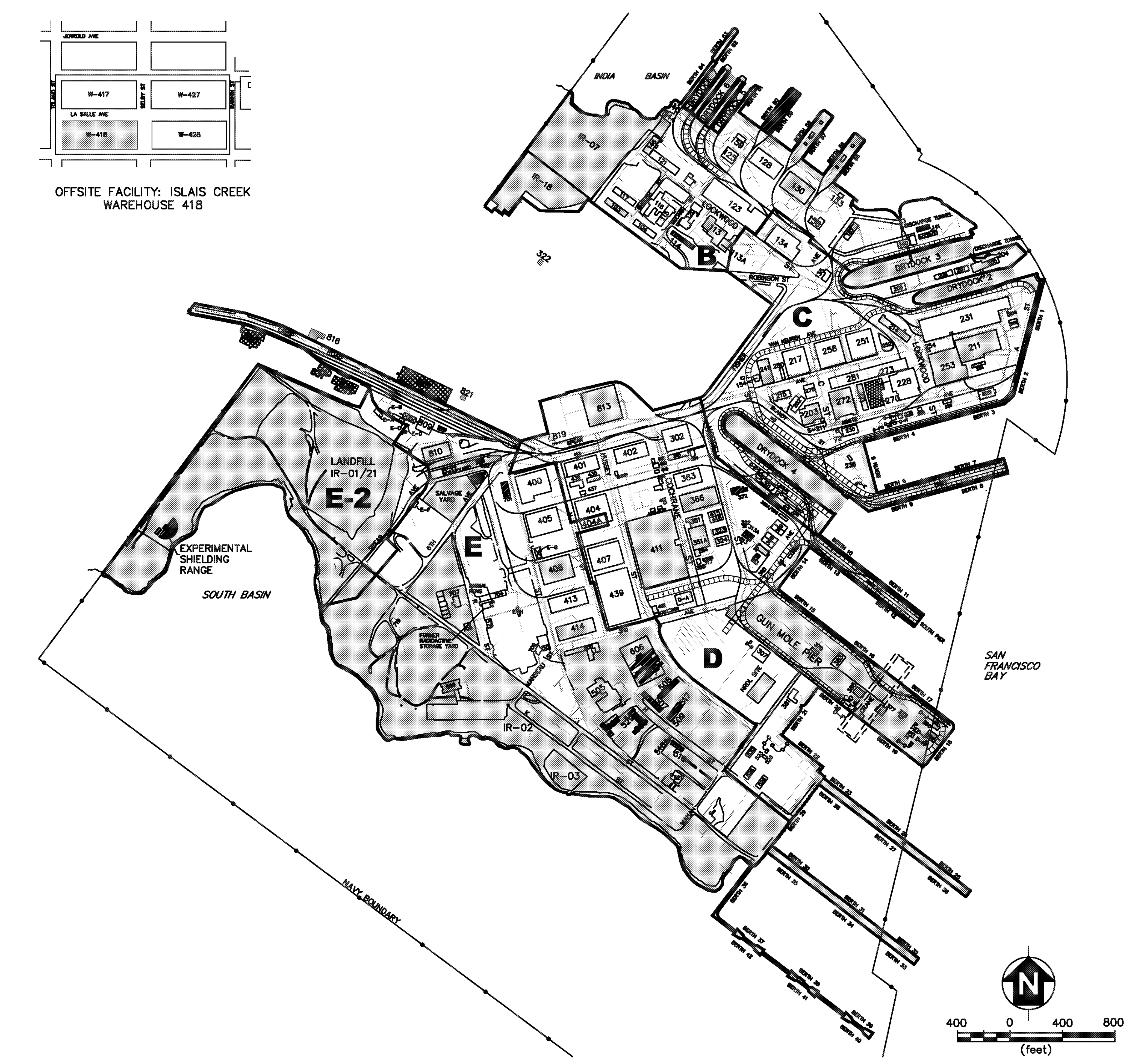
THREATENED AND ENDANGERED SPECIES AT OR NEAR HPS

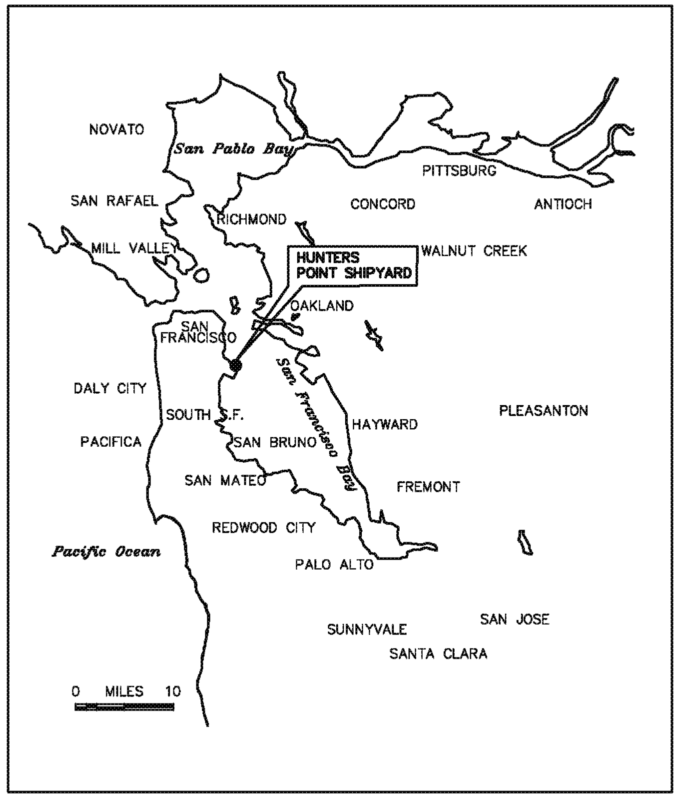
Scientific Name	Common Name	HPS Observations	Designation Codes
Ocnorhynchus tshawytscha	Chinook salmon	Observed	SSC, SE, FT
Gavia immer	Common loon	Observed	SSC
Pelecanus erythrorhychos	American white pelican	May be present	SSC
Pelecanus occidentalis californicus	California brown pelican	Observed	SE, FE
Phalacrocorax auritus	Double crested cormorant	Observed	SSC
Bucephala islandica	Barrow's goldeneye	Observed	SSC
Charadrius alexandrinus	Snowy plover	May be present	SSC
Numenius madagascariensis	Long-billed curlew	Observed	SSC
Larus californicus	California gull	Observed	SSC
Sterna caspia	Caspian tern	May be present	SSC
Sterna elegans	Elegant tern	May be present	SSC
Circus cyaneus	Northern harrier	May be present	SSC
Pandion haliaetus	Osprey	Observed	SSC
Falco peregrinus	Peregrine falcon	Observed	SE, FE
Asio flammeus	Short-eared owl	May be present	SSC
Athene cunicularia	Burrowing owl	Observed	SSC
Eremophila alpestris	Horned lark	May be present	SSC
Lanius ludovicianus	Loggerhead shrike	Observed	SSC
Geothlypis trichas	Common yellowthroat	May be present	SSC
Melospiza melodia	Song sparrow	May be present	SSC

Designation Codes:

FE – listed as endangered by the federal government
FT – listed as threatened by the federal government
HPS – Hunters Point Shipyard
SE – listed as endangered by the State of California
SSC – California Department of Fish and Game Species of Special Concern

FIGURES





LEGEND

- NAVY PROPERTY BOUNDARY (OFFSHORE)
- PARCEL BOUNDARY
- IMPACTED SANITARY SEWER SYSTEM
- IMPACTED STORM DRAIN SYSTEM
- IMPACTED BUILDINGS OR SITES
- DEMOLISHED IMPACTED BUILDINGS/STRUCTURES
- DEMOLISHED BUILDINGS/STRUCTURES
- IMPACTED SITES THAT HAVE OBTAINED REGULATORY RELEASE
- IMPACTED FUDS SITES
- NON-IMPACTED BUILDINGS WITHIN AN IMPACTED SITE, RADIOLOGICAL PRECAUTIONS MAY BE REQUIRED

NOTE

IMPACTED SITES ARE SITES THAT HAVE KNOWN RADIOLOGICAL CONTAMINATION OR WHERE SITE HISTORY INDICATES THAT RADIOLOGICAL CONTAMINATION MAY BE PRESENT.

FOR PLANNING PURPOSES, ALL STORM DRAINS & SANITARY SEWERS SHOULD BE CONSIDERED IMPACTED.

STORM AND SANITARY SEWER LINE LOCATIONS BASED ON DATA FROM HPS CSO (1995) AND THE FINAL HRA (AUG 2004) THAT HAS NOT BEEN FIELD CHECKED.

FIGURE 1-1

BASE-WIDE IMPACTED BUILDINGS, SITES, SANITARY AND STORM DRAIN SEWER SYSTEMS

HUNTERS POINT SHIPYARD-SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWING NO: 06035511.DWG

DCN: FWSD-RAC-06-0355 CTO: 0072

APPROVED BY: GS

CHECKED BY: CH REV: 0

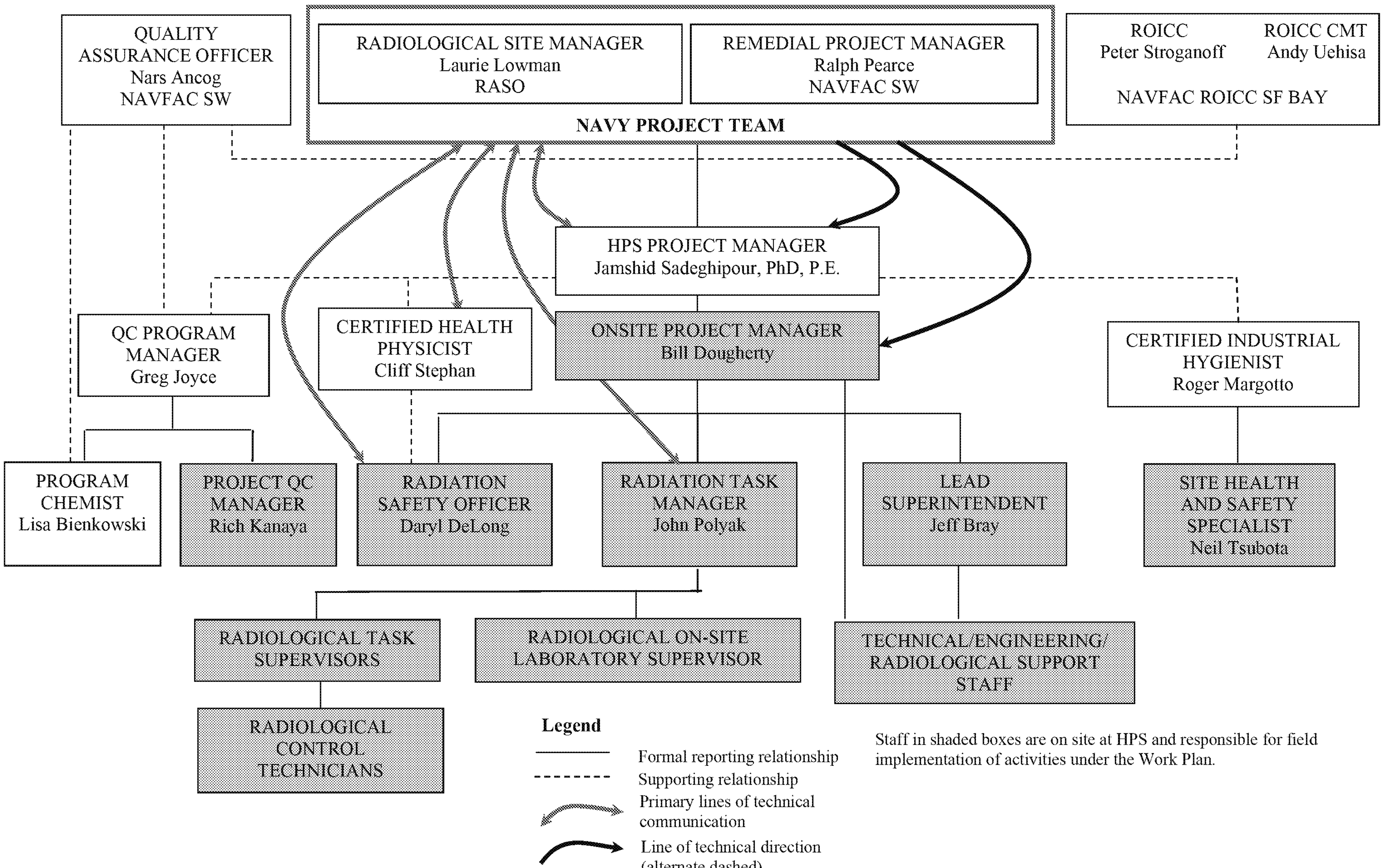
DRAWN BY: KLD DATE: 02/14/06

I:\1990-RAC\CTO-0072\DWG\060355\06035511.DWG
PLOT/UPDATE: OCTOBER 07 2005 08:09:41

ED_006787_00011211-00122

FIGURE 1-2

PROJECT ORGANIZATION CHART



Staff in shaded boxes are on site at HPS and responsible for field implementation of activities under the Work Plan.

ATTACHMENT 1

PROCEDURE FOR BURIED DRUMS, BOTTLES, JARS, AND CONTAINERS WITH UNKNOWN CONTENT

ATTACHMENT 1

PROCEDURE FOR BURIED DRUMS, BOTTLES, JARS, AND CONTAINERS WITH UNKNOWN CONTENT

1.1 PURPOSE

The following sections outline the procedures for handling and removal of buried drums, bottles, jars and/or containers (containers) unearthered during removal actions. The procedure addresses the identification and inspection of buried containers, their recovery and removal from the excavation, Hazardous Categorization (HazCat), waste catergorization sampling, temporary staging on site and disposal.

1.2 EQUIPMENT AND MATERIALS

Specialized equipment, tools, and supplies that may be required for container removal activities include (the need for specialized equipment will be evaluated on a case-to-case basis):

- Excavator equipped with drum grappler, bladed bucket (demolition grading)
- Loader/backhoe
- Shovels
- Blast shields for personnel protection
- Non-sparking/brass hand tools
- Remote drum opener/punch
- Air monitoring equipment, flame ionization detector (FID), photoionization detector (PID), radiation meter, combustible gas indicator/oxygen meter or similar
- Level B PPE to include: saranax suits, silvershield gloves, supplied air respirators
- Over-pack containers
- Spill containment kit (pads, oil dry, etc.)
- ABC fire extinguisher
- Air/water hoses
- Pumping equipment
- Radiation detection instrumentation
- Sampling and characterization kit
- Camera
- Labeling equipment

1.3 REMOVAL SEQUENCE

The following sequence will be followed once a container is encountered during the excavation activities):

- Uncovering chemical or unknown containers
- Review previous site characterization data (see geophysical survey results)
- Mobilize recovery team for evaluation/inspection of exposed containers
- Establish work zones/containment
- Radiological screening of containers
- Material excavation and transfer
- Container sampling
- Waste compatibility screening/"HazCat"
- Over-packing or lab-packing (container selection conducted following the HazCat analysis)
- Segregation, sampling and containerization of soil impacted with chemicals from the unknown containers
- Labeling of all containers with preliminary determination and accumulation start date and staging of all containers within the 90-day accumulation area
- Pre-disposal analysis and authorization for disposal
- Final labeling of containers based on analytical results
- Preparation of manifests
- Loading, transportation and disposal

1.4 WEATHER CONSIDERATIONS

Weather conditions will be considered prior to excavation of containers. Primary weather concerns are wind direction/velocity and precipitation. Wind direction will be considered and a safe distance during the removal of unknown contaminants will be established to ensure that workers downwind are not at risk. Airborne releases may be controlled by water mists, foam blankets, airtight enclosures, covering the container with earthen materials, or other suitable means. Precipitation is a concern due to the potential for contaminant migration (including inadvertent discharge, overflow, etc.), cross contamination, and chemical reactions. The potential for cross contamination and materials migration can be controlled by berms, trenches, covers, and/or sumps.

1.5 EXCAVATION OF CONTAINERS AND SOIL

Once a container with unknown content has been uncovered, all nonessential personnel will remain at a minimum 25 feet away from the excavation area. When possible, personnel should be upwind of the excavation and behind a solid barrier such as a berm, vehicle or heavy equipment. A recovery team (team leader, technician, RCT, stand-by health and safety support personnel) in Level B PPE will be deployed to inspect the container and/or area with unknown chemicals and together with the Project Site-superintendent determine the approach for the removal.

The excavation area will be examined to determine the general condition and burial depth of the containers. Air monitoring will be performed to determine if contaminant concentrations within the excavation exceeds background readings. If radioactive materials are encountered, work will not proceed until the radiation safety officer has inspected and evaluated the situation. Removal of radioactive material and mixed waste will be carried out in accordance with the Work Plan.

Once an area with containers of unknown materials is uncovered, and after air monitoring has been conducted, the recovery team will inspect for external markings that may reveal the drum or container content and/or generator. If the container is a drum, the feasibility of using a mechanical grappler will be evaluated. If the burial site is severely decayed, the appropriateness for mass excavation of the site will also be evaluated.

Prior to physically handling any container, the following checklist will be applied:

1. Is the container radioactively contaminated?
2. Does the container appear to be intact or open/damaged? Does the container exhibit leakage or deterioration (i.e., is it unsound)?
3. Does the container exhibit apparent internal pressure?
4. Is the container empty?
5. Does the container contain markings that would indicate that the contents are potentially explosive or reactive?
6. If the container is open or broken, does the container contain radioactive material(s)?

Specific items to look for when evaluating the integrity of buried containers include corrosion, rust, scaling, leakage, crystallization, bulging, smoking, hissing, fuming, unusual discoloration, etc. If compressed gas cylinders are discovered, they will be inspected thoroughly by a competent employee prior to movement.

The primary requirement for successful movement of a container is the integrity of the container shell; if the walls or ends are decayed, lifting of the container safely may not be possible.

After the exposed face of the burial site has been examined and the approach determined, the equipment operator can begin removing the containers.

1.6 MASS EXCAVATION

Mass excavation is usually performed when containers containing solid matter are in a serious state of decay, indistinguishable from one another, the contents are compatible, and the issue of ownership has been determined or there is little possibility of finding meaningful evidence of origin or prior use.

Prior to excavation, the area will be surveyed for radioactive material as per Section 4.0 of the Work Plan, as well as inspected for compressed gas cylinders or other similar pressurized containers or surficial large containers with contents. The burial area will be excavated or removed in an orderly manner. Once the area to be excavated has been evaluated to be safe for mass excavation and clearly delineated, the removal activities can start. The excavated soil and container materials will be spread out at a temporary laydown area consisting of two 20-mil layers of HDPE, PVC liner or solid polyethylene trays as appropriate located next to the identified burial site. A recovery team in level B PPE will go through and remove containers from the excavated material. Liners will be inspected for evidence of breaches (including breaks, bubbles or distortion) on a frequent basis. If liner breaches are observed, the field team will evaluate substitution to solid trays. The excavated soil will be segregated for separate waste profile sampling and disposal. Each waste container will be sampled and analyzed for radioactive material and waste compatibility screened (HazCat). The excavated material will also be isolated from any potential source of run-on from surface water or other liquids. Areas with pooled liquids will be pumped dry and the liquids contained.

1.7 CONTAINER IDENTIFICATION NUMBERS

Prior to removal of the container, a unique container identification number will be assigned to each buried container in accordance with an established numbering system for the project. The identification number will be marked on the exterior of the container with fluorescent paint or a grease stick, by application of a label, or by other approved means. The expected duration of any anticipated temporary storage will be considered when determining the type of marking/labeling system to be employed. Some markings, such as grease pencils and fluorescent paints, may become illegible after relatively short exposures to the environment.

The following information will be recorded in the field logbook:

- Container number
- Name of person logging data
- Date and time of container removal

- Container type
- Location where container was found
- Container condition
- Container size
- Labels and markings
- Disposition of container
- Photographic documentation

Once the condition of a container has been determined, it will be removed from the excavation either individually or by mass excavation. If necessary, containers will be transferred into an over-pack container prior to removal from the excavation. Each container or over-pack will be assigned a unique number, which will be marked on the exterior using either fluorescent paint or a grease stick. The drum number will also be recorded in the TtEC site drum log. If there is evidence of container breakage or leaking, soil generated and associated with mass excavation of small containers or bottles will be segregated, analyzed and profiled for disposal.

1.8 HANDLING AND STAGING OF CONTAINERS

Moving and transporting containers will be accomplished with the use of mechanical equipment. Manual handling of containers will be kept to a minimum and only used should mechanical equipment not be practical. Remote container handling equipment may consist of a grappler-equipped backhoe or front-end loader. Container transportation will be with front-end loaders or fork lifts with modified carrying platforms. Handling and transport equipment will be equipped with full frontal and side splash shields as appropriate. Container handling equipment will be fitted with a Class ABC fire extinguisher that is immediately accessible to the operator. The size and number of extinguishers will be determined by the SHSS.

1.8.1 Special Handling

Containers exhibiting the following characteristics require special treatment in handling and sampling:

- Leaking or deteriorated drums
- Bulging drums
- Drums containing explosive or shock-sensitive waste
- Drums containing or contaminated with radioactive waste
- Packaged laboratory wastes (Lab-packs)
- Air reactive waste

When containers are moved, they will be taken to an upwind staging and sampling area located upwind of the burial site. This area will be away from other drums on the site until HazCat analysis to prevent a chain reaction from occurring between incompatible materials.

Leaking of Deteriorated Containers

If containers exhibit leakage or apparent deterioration such that movement may cause rupture (determined by the SHSS or recovery team lead), they will immediately be inspected and, if deemed appropriate, transferred to an over-pack drum.

Bulging Containers

Containers that potentially may be under internal pressure, as evidenced by bulging, will be sampled in place. Extreme care will be exercised when working with and adjacent to potentially pressurized containers. Should movement of a pressurized drum be unavoidable, they will be handled only by a grappler unit constructed for explosive containment. The bulging container will be moved only as far as necessary to allow seating on firm ground or it will be carefully over-packed.

Any open bungs or drill openings in pressurized containers will be plugged with pressure-venting caps set to a 5 pounds per square inch (psi) release to allow venting of vapor pressure as outlined in the *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* [National Institute for Occupational Safety and Health (NIOSH), 1985]. Creation of explosive conditions will be avoided.

If intact compressed gas cylinders are encountered, they will be handled and removed by a specialized gas cylinder disposal subcontractor.

Containers Containing Explosive or Shock-sensitive Waste

If containers are found containing wastes that have been identified by prior sampling or are suspected by visual examination to be explosive in nature, the Site Superintendent and SHSS will be notified immediately, before the drums are handled in any way. If the Site Superintendent and/or SHSS approve handling of these drums, they will be handled with extreme caution. Initial handling will be by a grappler unit constructed for explosive containment. Containers will be palletized prior to transport to a hazardous waste interim storage area prior to disposal.

If at any time during remedial activities, an explosive, pursuant to provisions of Title 18, USC, Chapter 40 (Importation, Manufacture, Distribution, and Storage of Explosive Materials, 1975 Explosives List) is identified, it will be secured and the appropriate state and federal agencies notified. Identification of an explosive substance will be done by experienced on-site personnel. Potentially explosive materials usually may be identified by their physical characteristics (texture, color, density, etc.), as well as the way they are packaged or labeled. Most explosives are solids. In some cases, they are packaged in water-tight containers to exclude water, while in other cases, they are packaged wet to preclude explosion.

Prior to handling or transporting containers containing explosive wastes, personnel working in the area will be removed to a safe distance (as determined by the SHSS). Continuous contact between handlers and the Site Superintendent and the SHSS will be maintained until handling or transporting operations are complete. An audible siren signal system, similar to that employed in conventional blasting operations, will be used to signify the commencement and completion of explosive waste handling or transporting activities.

Containers Containing Radioactive Waste

Containers containing radioactive or mixed wastes may be encountered at the site; however, no container will be handled until radiation and contamination levels have been determined by an initial field survey. The survey will include direct radiation and contamination measurements, as detailed in SOP HPO0-Tt-006, Radiation and Contamination Surveys, and SOP HPO-Tt-009, Sampling Procedures for Radiological Surveys.

Packaged Laboratory Wastes

If individual containers suspected of containing discarded laboratory chemicals, reagents or other potentially dangerous materials in small volume are found, the Site Superintendent and SHSS will be notified immediately, prior to any removal or opening of the containers or bottles. If the Site Superintendent and/or SHSS approve the handling or these containers, they will be handled with extreme caution. Until otherwise identified or categorized, they will be considered explosive or shock sensitive wastes and will be handled as described in the section above.

Air Reactive Wastes

If the presence of an air reactive substance is verified or suspected, as concluded by a competent person, the material will be immediately segregated and transported to a separate hazardous waste interim storage and disposal area.

Air reactive wastes may be discovered during opening or sampling operations. Air reactive substances normally require special packaging. They may be stored under water or some other liquid to minimize air contact. They may also be found in sealed ampules, corrugated drums, stainless steel canisters, or specially lined drums. If conditions become reactive, clean sand can be used to smother flammable materials.

1.9 OVER-PACKING OF DRUMS

An over-packing station will be constructed adjacent to the burial site in the temporary laydown area. Straw bales, 20-mil HDPE, PVC liner and/or solid polyethylene trays may be used for construction of this station. In situations where over-packing needs to take place outside the excavation boundary, it will be done carried out on top of already existing pads. Only materials screened for radioactive materials may be over-packed.

When using mechanical equipment, the equipment operator will pick up a container from the burial area, move to the over-pack station and gently slide the container into the over-pack. When handling a container, whether by mechanical means or by hand, the container will be examined for any sign of collapse or excessive leaking prior to lifting. The container will only be lifted as high as necessary to clear obstacles between the point of removal and the staging/over-pack area. Safe lifting practices will be observed at all times.

After the container has been screened for radioactive materials, it can be placed into the over-pack, and the lid of the defective container can be pierced with a brass punch. The brass punch is attached to the bucket of a backhoe, or other remotely operated device. The brass punch will be surveyed for radioactive contamination after piercing the container. The purpose of this operation is to provide an access port for sampling. Following this operation, the drum is either sampled or prepared for movement to the sampling area. Preparation for movement includes placing a stopper in the access port and securely installing the over-pack drum lid.

1.10 CONTAINER SAMPLE COLLECTION PROCEDURES

Sampling activities will be coordinated with the over-packing operations or container HazCat analysis. Sampling protocols are established in the SAP. All containers will be sampled and analyzed for the presence of radioactive materials. Samples collected for radiological analyses will be collected using SOP HPO-Tt-009. Samples will be analyzed by gamma spectroscopy and for gross alpha/beta. Additional analysis may be requested based upon sample results. Smaller containers and bottles will be transported in a safe manner (see AHA - Container Removal) to the HazCat area in Building 271 for individual categorization. The term “waste compatibility screening” or “HazCat” as used in this document refers to a series of rapid, qualitative chemical and physical tests conducted to determine potential hazards, handling precautions, storage criteria and disposal classification of the material in question. Container sample material will not be shipped until waste compatibility results have been reviewed and radiological screening complete.

1.11 CONTAINER SAMPLING FOR WASTE COMPATIBILITY SCREENING/ HAZCATING

All containers or over-packs will be kept sealed and resealed after sampling to prevent the escape of vapors and possible reactions from intrusion of rainwater, air, etc.

No container sampling may be performed until the drum has been examined from a health and safety stand point. If radioactivity greater than 3 sigma above background radiation levels are not detected, the RSO in conjunction with the SHSS may then, at their discretion, issue clearance to begin field sampling of inspected drums. If containers are deemed non-radioactive, sampling can take place.

Containers identified as containing radioactive material (radioactivity greater than 3 sigma above background) will require a RWP to be in place prior to opening or sampling.

The SHSS will continuously monitor the atmosphere around the work area before and during sample collection to ensure that sampling personnel employ an appropriate level of respiratory protection. Air sampling for radioactive particulates will also be performed.

During sampling, a thorough qualitative visual description of the contents of each container will be obtained and recorded in the Container Removal Inventory Logbook. This initial visual characterization includes noting the following:

- Any and all exterior markings (photographing if practical)
- Any unique or unusual container conditions (e.g., reinforced, lined, exotic construction materials, etc.) and the type of opening(s)
- The approximate amount of material contained in the container
- Physical state, color, clarity, viscosity, number and relative estimated volume of each identified discrete layer or phase
- Readings from real-time monitors

For liquids, samples will be extracted through the bunghole if there is one on the container. If the container contains mostly solid material rather than liquids, the entire top of the container will be removed and the contents will be sampled for chemicals in a star pattern. Sampling for radiological material will be executed in accordance with SOP HP-Tt-009, Sampling Procedures for Radiological Surveys. Using the appropriate sampling device or a combination of devices, several representative grab samples with a combined volume of approximately 250 milliliters (mL) will be withdrawn and carefully placed into a labeled, clean, clear glass sampling container with a Teflon-lined plastic lid. If a container contains more than one phase (e.g., solids and liquids or multi-phase liquids), separate samples are to be taken from each phase. If the volume of any individual phase is so small as to preclude recovery of a sufficient sample, a remark to this effect will be recorded in the Container Removal Inventory Logbook.

Information to be entered into the field logbook during sampling activities may also include the following:

- Container contents
- Physical state
- pH

- Air monitoring results
- Color
- Clarity
- Thickness of layers
- Radiological monitoring results
- Other observations

The log should be photocopied, a chain-of-custody completed, and samples delivered to a State-of California certified analytical laboratory.

Used disposable sampling equipment, paper towels or waste rags used to wipe up spills will be placed into an empty metal container for subsequent disposal. If glass tubing is used, it may be broken and left inside the container being sampled.

The bung or covers on containers will be replaced and the top of the over-pack secured, if used. Two custody seals will be affixed to opposite sides of the outermost cover, lid or across the bung opening.

The outside surface of the sample containers will be thoroughly cleaned then transferred to the HazCat area (Building 271) where the HazCat Technician(s) will carry out waste compatibility screening. The waste compatibility screening tests include:

- Water Reactivity (air or water reactive)
- Miscibility (aqueous vs. organic solubility)
- Flammability and Explosivity
- pH
- Presence of Sulfide and Cyanide
- Presence of Significant Halogen Content
- Presence of Oxidizers and Peroxides
- Field Compatibility for Uncharacterized Wastes.

1.12 SAMPLING OF INTACT EXCAVATED DRUMS AND LARGE CONTAINERS

The required method of opening drums is by remote means. Three types of equipment for opening drums remotely are available: the bung spinner, the remote-controlled drill, and the hydraulic or pneumatic drum piercer. When any of these pieces of equipment are used, the opening device is attached to the drum and the control lines are extended to their maximum length (typically 100 feet). Drum-opening personnel will operate the controls from behind sandbags, a concrete or brick structure, or other solid barriers. The contact surfaces of the drum opening equipment will be decontaminated after each use. The drum opening equipment will be surveyed for radioactive contamination prior to chemical decontamination.

1.13 RESEALING CONTAINERS

All drums/containers opened during the sampling investigation need to be resealed to prevent the escape of vapors and any possible reactions with rainwater, air, etc. The resealing methods will depend on the opening methods used and will include the following:

- Replacing the bung, screw cap, etc.
- Replacing the lid and retaining ring
- Placing the drum in an over-pack
- Using the non-reactive special rubber or plastic plug if a hole was driller. If utilized, these plugs will be checked periodically for soundness since material within the drum may react with the plug and cause it to corrode/leak. A drum bonnet will also be used to ensure that rainwater does not seep around the plug.

These sealing methods are for the purpose of preventing leakage from containers while in storage on site. If a container is moved off site, DOT drum sealing requirements must be met. DOT regulations generally have more rigorous sealing procedures than the sealing methods listed above.

Once containers are sampled and resealed, they will be placed where they cannot react with other containers on the site. Slowly progressing chemical reactions can start when a container is moved and/or opened, as the contents have been exposed to air and/or have been disturbed by handling the drum. Such a reaction could take hours or even days to occur. Segregation of the containers will be carried out according to hazard class, to prevent any potential chemical reactions between containers. For a small number of containers, the storage area(s) may be the staging and opening area. Mixed waste will be transferred and stored in the mixed waste storage area.

Sample identification, packaging, shipment and analytical protocols are provided in the site drum log.

1.14 STAGING

Containers will be stored in a secure area according to compatibility grouping. The staging area will be located in a remote or controlled environment area away from other operations. Staging area construction usually includes: an impermeable liner, secondary containment, run-on collection systems, a roof, and a location above the floodplain. The minimum requirements may be met with double 20-mil liners, straw bales for sidewalls, a tarp cover, and caution tape.

APPENDIX A

SAMPLING AND ANALYSIS PLAN

SAP Worksheet #1 – Title and Approval Page

APPENDIX A

FINAL
SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
Revision 4

July 2010

BASE-WIDE STORM DRAIN AND SANITARY SEWER REMOVAL
HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA

Prepared for:
Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

Prepared by:
Tetra Tech EC, Inc.
1230 Columbia Street, Suite 750
San Diego, California 92101
(619) 234-8696

Prepared under:
Contract No. N62473-07-D-3211
DCN: FWSD-RAC-06-0675.R4
CTO No. 0018

Review Signature: Lisa A. Bienkowski for 07/09/10
Gregory Joyce
TtEC Quality Control Program Manager
Date

Approval Signature: Narciso Allan Ancog 7/20/2010
Narciso A. Ancog
NAVFAC SW Quality Assurance Officer
Date

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EXECUTIVE SUMMARY

This Sampling and Analysis Plan (SAP) has been prepared by Tetra Tech EC, Inc. under the Naval Facilities Engineering Command Southwest Remedial Action Contract (RAC) IV No. N62473-06-D-2201, Contract Task Order (CTO) No. 0006. This SAP supersedes the Base-Wide Storm Drain and Sanitary Sewer Removal Project Work Plan (TtEC 2006), Sampling and Analysis Plan for the Base-Wide Sewer Systems (DCN: FWSD-RAC-06-0675) prepared under RAC III No. N68711-98-D-5713, CTO No. 0072. This SAP is Revision 4 under DCN: FWSD-RAC-06-0675. This revision includes updating the SAP to the Uniform Federal Policy for Quality Assurance Project Plans format of the 37 worksheets and updating any laboratory information that may have changed since Revision 3.

BACKGROUND

The purpose of this base-wide SAP is to provide guidance on sampling, analysis, and quality assurance (QA) for specific sampling activities pertaining to the storm drain and sewer line system removal projects at Hunters Point Shipyard (HPS), San Francisco, California, which may be performed under other another CTO, Task Order, or contract number.

The Department of the Navy (DON) reviewed the HPS operational history, the final Historical Radiological Assessment (HRA), Volume II (NAVSEA 2004), and site-specific investigative data and determined that the storm drains and sanitary sewers contain radioactive material requiring a response action. This decision is documented in the final Base-wide Radiological Removal Action, Action Memorandum – Revision 2006, Hunters Point Shipyard, San Francisco, California (DON 2006), hereinafter referred to as the Action Memorandum (AM), which was prepared to direct removal actions within various areas throughout the base that contain radioactive contamination. This removal action will serve to substantially eliminate the potential threat posed by future migration and/or off-site release of radioactive material present at the base into the surrounding environment. Currently, such a release could occur as a result of wastewater or stormwater transport, erosion, weathering, seismic events, or biological activity.

This base-wide SAP will be used as a reference document by all field and laboratory personnel engaged in the sampling and analysis activities for the removal projects. Included in this SAP are data quality objectives, field sampling procedures, QA/quality control (QC) requirements, and data gathering methods that will be used for projects related to storm drain and sewer line system removal. The QA elements of this SAP were prepared in accordance with the Uniform Federal Policy for Quality Assurance Project Plans (EPA 2005) and U.S. Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans, EPA QA/R-5, QAMS (EPA 2006b) to ensure that all data collected are precise, accurate, representative, complete, and comparable to meet their intended use.

OBJECTIVES

The objectives of this base-wide SAP are to 1) provide guidance for the field sampling activities; 2) describe and establish consistent field sampling procedures; 3) establish data gathering, handling, and documentation methods; and, 4) define QA/QC measures to ensure consistency and confidence in the data obtained.

The primary objectives of the removal action are to extract subsurface storm and sewer piping systems and soil present in or around the piping that may contain radioactive contaminants and to dispose of any contaminated material. The HRA (NAVSEA 2004) listed cesium-137 (^{137}Cs), radium-226 (^{226}Ra), and strontium-90 (^{90}Sr) as the radionuclides of concern for the sanitary sewer and storm drain system. However, additional radionuclides of concern are identified at other radiologically impacted sites at HPS. Therefore, it was not intended to limit the radioactive contaminants to those isotopes, and additional isotopes will be evaluated during the performance of this work as appropriate.

If additional radionuclides are encountered, the cleanup goals established in the AM (DON 2006) will be adopted. Radioactive materials encountered during the removal action that exceed the radiological remedial objectives (RROs) will be removed for disposal as radioactive waste. The removal action will serve to substantially eliminate the potential threat posed by future migration or release of radioactive material present in the systems into the surrounding environment.

ACTION LEVELS

Prior radiological investigations have confirmed the presence of ^{226}Ra and ^{137}Cs within the HPS storm drain and sanitary sewer line systems. The presence of other radionuclides, such as ^{90}Sr, will be assessed during the screening-process activities. Table A-1 provides the RROs for these and other radionuclides of concern at HPS that have been established by the DON in consonance with the EPA, Region IX.

Chemical contamination at HPS will be addressed through the Installation Restoration Program (IRP) process, consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

REGULATORY OVERSIGHT

The removal action is being conducted in accordance with the requirements of CERCLA and NCP. Under Executive Order 12580, the DON is the lead agency responsible for implementation of the IRP. The EPA, California Environmental Protection Agency, Department of Toxic Substances Control, Regional Water Quality Control Board, Radiological Affairs Support Office, and United States Fish and Wildlife Service (for sensitive species) will provide regulatory oversight and guidance for removal actions associated with the storm drain and sewer line system removal.

TABLE A-1
RADIOLOGICAL REMEDIAL OBJECTIVES

Radionuclide	Surfaces (dpm/100 cm^2)		Soil [a] (pCi/g)		Water [e] (pCi/L)
	Equipment Waste [b]	Structures [c]	Outdoor Worker [d]	Residential [d]	
Americium-241	100	100	5.67	1.36	15
Cesium-137	5,000	5,000	0.113	0.113	119
Cobalt-60	5,000	5,000	0.0602	0.0361	100
Plutonium-239	100	100	14.0	2.59	15
Radium-226	100	100	1.0 [f]	1.0 [f]	5.0 [g]
Strontium-90	1,000	1,000	10.8	0.331	8
Thorium-232	1,000	36.5	2.7	1.69	15
Tritium (^3H)	5,000	5,000	4.23	2.28	20,000
Uranium-235+D	5,000	488	0.398	0.195	30

Notes:

[a] EPA PRGs for two future-use scenarios.

[b] These limits are based on AEC Regulatory Guide 1.86 (AEC 1974). Limits for removable surface activity are 20 percent of these values.

[c] These limits are based on 25 millirems per year, using RESRAD-Build Version 3.3 or Regulatory Guide 1.86, whichever is lower.

[d] The on-site and off-site laboratory will ensure that the MDA meets the listed release criteria by increasing sample size or counting time as necessary. The MDA is defined as the lowest net response level, in counts, that can be seen with a fixed level of certainty, customarily 95 percent. The MDA is calculated per sample by considering background counts, amount of sample used, and counting time.

[e] Release criteria for water have been derived from Radionuclides Notice of Data Availability Technical Support Document, (EPA 2000) by comparing the limits from two criteria and using the most conservative limit.

[f] Limit is 1 pCi/g above background per agreement with EPA.

[g] Limit is for total radium concentration.

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ATTACHMENTS

Attachment 1 Example of Chain-of-Custody, Sample Label, Custody Seal, and Field Forms
Attachment 2 Hunters Point Shipyard Standard Operating Procedures

Abbreviations and Acronyms

%D	percent difference
%R	percent recovery
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
AA	atomic absorption
AEC	Atomic Energy Commission
AES	atomic emission spectrometer
AM	Action Memorandum
^{241}Am	americium-241
BHC	benzene hexachloride
BRAC	Base Realignment and Closure
°C	degrees Celsius
CA	corrective action
Cal/EPA	California Environmental Protection Agency
CAS	Chemical Abstracts Service
CCB	continuing calibration blank
CCV	continuing calibration verification
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm^2	square centimeter
CN	cyanide
COC	chain of custody
COD	chemical oxygen demand
CPM	counts per minute
^{137}Cs	cesium-137
CSO	Caretaker Site Office
CTO	Contract Task Order
CV	calibration verification
CVAA	cold vapor atomic absorption
DCC	daily calibration check
DCN	Document Control Number
DHS	(California) Department of Health Services

Abbreviations and Acronyms
(Continued)

DOE	Department of Energy
DON	Department of the Navy
dpm	disintegrations per minute
DQA	data quality assessment
DQO	Data Quality Objective
DTSC	Department of Toxic Substances Control
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
ES	excavated soil
EWI	Environmental Work Instruction
FCR	Field Change Request
FID	flame ionization detector
FSS	Final Status Survey
g	gram
GC	gas chromatograph
GC/MS	gas chromatograph/mass spectrometer
^{3}H	tritium
HCl	hydrochloric acid
HNO_3	nitric acid
HPGe	high-purity germanium
HPS	Hunters Point Shipyard
HRA	Historical Radiological Assessment
ICAL	initial calibration
ICB	initial calibration blank
ICP	inductively coupled plasma
ICS	interference check sample
ICV	initial calibration verification
IR	Installation Restoration (Program)
IRCDQM	Installation Restoration Chemical Data Quality Manual
IRP	Installation Restoration Program
KeV	kiloelectron volt
L	liter

Abbreviations and Acronyms
(Continued)

LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LDC	Laboratory Data Consultants
LLRW	low-level radioactive waste
m^2	square meter
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MCPA	2-methyl-4-chlorophenoxyacetic acid
MCPP	2-(2-methyl-4-chlorophenoxy)-propionic acid
MDA	minimum detectable activity
MDL	method detection limit
MeV	megaelecton volt
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
MS	matrix spike
MSA	Method of Standard Addition
MSD	matrix spike duplicate
N/A	not applicable
NaI	sodium iodide
NaOH	sodium hydroxide
NAVFAC SW	Naval Facilities Engineering Command Southwest
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEDD	Navy Electronic Data Deliverable
NFESC	Naval Facilities Engineering Service Center (formerly NEESA)
NIST	National Institute of Standards and Technology
NRDL	Naval Radiological Defense Laboratory
NWT	New World Technology, Inc.
OOS	out of service
OSHA	Occupational Safety and Health Administration
PAH	polynuclear aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, completeness, and comparability
PCB	polychlorinated biphenyl

Abbreviations and Acronyms
(Continued)

pCi/g	picocuries per gram
pCi/L	picocuries per liter
PE	performance evaluation
PID	photoionization detector
PjM	Project Manager
PQCM	Project Quality Control Manager
PRG	preliminary remediation goal
PRSO	Project Radiation Safety Officer
^{239}Pu	plutonium-239
QA	quality assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	quality control
QCPM	Quality Control Program Manager
QL	quantitation limit
QSM	Quality Systems Manual
^{226}Ra	radium-226
RAC	Remedial Action Contract
RASO	Radiological Affairs Support Office
RER	relative error ratio
RL	reporting limit
ROICC	Resident Officer in Charge of Construction
RPD	relative percent difference
RPM	Remedial Project Manager
RRO	radiological remedial objective
RSD	relative standard deviation
RSL	Regional Screening Level
RSM	Radiological Site Manager
RSO	Radiation Safety Officer
RSOR	Radiation Safety Office Representative
RSRS	Radiological Survey & Remedial Services, LLC
RSY	Radiological Screening Yard

Abbreviations and Acronyms
(Continued)

SAP	Sampling and Analysis Plan
SDG	sample delivery group
SIM	selective ion monitoring
SOP	Standard Operating Procedure
^{90}Sr	strontium-90
SVOC	semivolatile organic compound
TBD	to be determined
^{232}Th	thorium-232
TO	Task Order
TOG	total oil and grease
TPH	total petroleum hydrocarbons
TPH-d	total petroleum hydrocarbons quantified as diesel
TPH-extractable	total extractable petroleum hydrocarbons
TPH-g	total petroleum hydrocarbons quantified as gasoline
TPH-mo	total petroleum hydrocarbons quantified as motor oil
TPH-purgeable	total purgeable petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
TSS	total suspended solids
TtEC	Tetra Tech EC, Inc.
TU	Trench Unit
^{235}U	uranium-235
UFP	Uniform Federal Policy
USFWS	United States Fish and Wildlife Service
UST	underground storage tank
VOA	volatile organic analysis
VOC	volatile organic compound
VSP	Visual Sample Plan
Water Board	Regional Water Quality Control Board
WO	waste oil
Yt	Yttrium
ZnAC	zinc acetate

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SAP Worksheet #2 – SAP Identifying Information

Site Name/Number:	**Base-Wide Storm Drain and Sanitary Sewer Removal Hunters Point Shipyard (HPS)**
Contractor Name:	**Tetra Tech EC, Inc. (TtEC)**
Contract Number:	**N62473-06-D-2201**
Contract Title:	**Environmental Remedial Action Contract IV**

1. This Sampling and Analysis Plan (SAP) was prepared in accordance with the requirements of the Uniform Federal Policy for Quality Assurance Project Plans (EPA 2005) and U.S. Environmental Protection Agency (EPA) Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS (EPA 2002).

2. Identify regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

3. This SAP is a project-specific base-wide SAP.

4. List dates of scoping sessions that were held.

Scoping Session	Date
Not applicable	

5. List dates and titles of any SAP documents written for previous site work that are relevant to the current investigation.

Title	Date
Not applicable	

6. List organizational partners (stakeholders) and connection with lead organization: The EPA, California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC), Regional Water Quality Control Board (Water Board), Radiological Affairs Support Office (RASO), and United States Fish and Wildlife Service (USFWS) (for sensitive species) will provide regulatory oversight and guidance for removal actions associated with the storm drain and sewer line system removal.

7. Lead organization: The Department of the Navy (DON), with state regulatory oversight, is the lead agency.

8. If any required SAP elements or required information is not applicable to the project or is provided elsewhere, then note the omitted SAP elements and provide an explanation for its exclusion below:

    - Worksheet #9 (Project Scoping Session Participants Sheet) is not applicable for this Revision 4 as the project scoping sessions were performed during the Preliminary Draft stages of the original SAP.

SAP Worksheet #2 – SAP Identifying Information (Continued)

- Worksheet #13 (Secondary Data Sources) is not applicable for this project as secondary data evaluation is not required.
- Worksheet #21 (Project Sampling SOPs Reference Table) is not included in this SAP since the sampling procedures are described in detail in Worksheet #14, although one Standard Operating Procedure (SOP) is attached as a reference for radiological sampling.

SAP elements and required information that are not applicable to the project are noted below. An explanation is provided on the previous page and in the appropriate SAP worksheet(s), as necessary.

UFP-QAPP Worksheet #	Required Information	Crosswalk to Related Information
A. Project Management		
Documentation		
1	Title and Approval Page	
2	Table of Contents SAP Identifying Information	
3	Distribution List	
4	Project Personnel Sign-Off Sheet	
Project Organization		
5	Project Organizational Chart	
6	Communication Pathways	
7	Personnel Responsibilities and Qualifications Table	
8	Special Personnel Training Requirements Table	
Project Planning/Problem Definition		
9	Project Planning Session Documentation (including Data Needs tables) Project Scoping Session Participants Sheet	Not applicable
10	Problem Definition, Site History, and Background. Site Maps (historical and present)	
11	Site-Specific Project Quality Objectives	
12	Measurement Performance Criteria Table	
13	Sources of Secondary Data and Information Secondary Data Criteria and Limitations Table	Not applicable
14	Summary of Project Tasks	
15	Reference Limits and Evaluation Table	
16	Project Schedule/Timeline Table	
B. Measurement Data Acquisition		
Sampling Tasks		

SAP Worksheet #2 – SAP Identifying Information (Continued)

UFP-QAPP Worksheet #	Required Information	Crosswalk to Related Information
17	Sampling Design and Rationale	
18	Sampling Locations and Methods/ SOP Requirements Table Sampling Location Map(s)	
19	Analytical Methods/SOP Requirements Table	
20	Field Quality Control Sample Summary Table	
21	Project Sampling SOP References Table	Not applicable
22	Field Equipment Calibration, Maintenance, Testing, and Inspection Table	
Analytical Tasks		
23	Analytical SOPs Analytical SOP References Table	
24	Analytical Instrument Calibration Table	
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	
Sample Collection		
26	Sample Handling System, Documentation Collection, Tracking, Archiving and Disposal Sample Handling Flow Diagram	
27	Sample Custody Requirements, Procedures/SOPs Sample Container Identification Example Chain-of-Custody Form and Seal	
Quality Control Samples		
28	QC Samples Table Screening/Confirmatory Analysis Decision Tree	
Data Management Tasks		
29	Project Documents and Records Table	
30	Analytical Services Table Analytical and Data Management SOPs	
C. Assessment Oversight		
31	Planned Project Assessments Table Audit Checklists	
32	Assessment Findings and Corrective Action Responses Table	
33	QA Management Reports Table	
D. Data Review		
34	Verification (Step I) Process Table	
35	Validation (Steps IIa and IIb) Process Table	
36	Validation (Steps IIa and IIb) Summary Table	
37	Usability Assessment	

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SAP Worksheet #3 – Distribution List

The following distribution list represents the recipients of the final version of this SAP.

Name of SAP Recipients	Title/Role	Organization	Telephone Number	Mailing and E-mail Address
Mr. Chris Yantos	DON Remedial Project Manager	NAVFAC SW	(619) 532-0912	1455 Frazee Road, Suite 900 San Diego, CA 92108-4310 christopher.yantos.ctr@navy.mil
Ms. Laurie Lowman	Radiological Environmental Protection Manager	RASO	(757) 887-4692	Building 1971 NWS P.O. Drawer 260 Yorktown, VA 23691-0260 laurie.lowman@navy.mil
Mr. Narciso Ancog	Quality Assurance Officer	NAVFAC SW	(619) 532-3046	1220 Pacific Coast Highway San Diego, CA 92132 narciso.ancog@navy.mil
Ms. Diane Silva	Administrative Record Manager	NAVFAC SW	(619) 532-3676	937 N. Harbor Drive Building 1, 3rd Floor San Diego, CA 92132 diane.silva@navy.mil
Mr. Mike Mentink	Caretakers Site Office	BRAC CSO HPS	(415) 743-4729	1 Avenue of the Palms, Suite 161 San Francisco, CA 94130 mike.mentink@navy.mil
Mr. Ryan Miya	DTSC Lead RPM	Cal/EPA DTSC	(510) 540-3775	700 Heinz Ave., Bldg. F, Suite 200 Berkeley, CA 94710-2721 rmiya@dtsc.ca.gov
Mr. Jim Ponton	RPM	California Water Board, San Francisco Bay Region	(510) 622-2492	1515 Clay Street, Suite 1400 Oakland, California 94612 jponton@waterboards.ca.gov
Mr. Mark Ripperda	EPA-RPM	EPA	(415) 972-3028	75 Hawthorne Street San Francisco, CA 94105 ripperda.mark@epa.gov

SAP Worksheet #3 – Distribution List (Continued)

Name of SAP Recipients	Title/Role	Organization	Telephone Number	Mailing and E-mail Address
Ms. Shirley Ng	ROICC	NAVFAC SW	(510) 749-5939	2450 Saratoga Street, Suite 200 Alameda, CA 94501-7545 shirley.ng@navy.mil
Mr. Bill Dougherty	Project Manager	TtEC	(415) 216-2731	200 Fisher Avenue San Francisco, CA 94124 bill.dougherty@tetratech.com
Mr. Erik Abkemeier	Radiation Safety Officer	Tetra Tech EC, Inc.	(757) 466-4906	Twin Oaks, Suite 309 5700 Lake Wright Drive Norfolk, VA 23502 erik.abkemeier@tetratech.com
Mr. Gregory Joyce	QC Program Manager	TtEC	(360) 598-8117	1230 Columbia St., Suite 750 San Diego, CA 92101 greg.joyce@tetratech.com
Ms. Lisa A. Bienkowski	Program Chemist	TtEC	(494) 756-7592	1940 E. Deere Ave., Suite 200 Santa Ana, CA 92705 lisa.bienkowski@tetratech.com
Mr. Paul Wall	Laboratory Manager	NWT	(415) 216-2739	200 Fisher Avenue San Francisco, CA 94124 paulw@newworld.org
Mr. Ivan Vania	Laboratory Project Manager	TestAmerica, Inc. (St. Louis)	(314) 298-8566	13715 Rider Trail North Earth City, MO 63045 ivan.vania@testamericainc.com
Ms. Linda Rauto	Data Validator Project Manager	LDC	(760) 634-0437	7750 EL Camino Real, Suite 2L Carlsbad, CA 92009 lrauto@lab-data.com

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SAP Worksheet #4 – Project Personnel Sign-Off Sheet

The key personnel listed below will read the final version of this SAP. Their signature and date will be filled in below and included in the project file.

Name	Organization/Title/Role	Signature/Email Receipt	SAP Section Reviewed	Date SAP Read
Mr. Bill Dougherty	TtEC/Project Manager		Entire document	
Ms. Sabina Sudoko	TtEC/Project Chemist		Entire document	
Mr. Richard Kanaya	TtEC/Project Quality Control Manager		Entire document	
Mr. Paul Wall	NWT /Laboratory Manager		Entire document	
Mr. Ivan Vania	TestAmerica-St. Louis /Laboratory Project Manager		Entire document	
Ms. Linda Rauto	LDC /Data Validator Project Manager		Entire document	
TBD [a]	TtEC / Field Crews		Entire Document	

Notes:

[a] Field crews include multiple persons and vary from project to project. Therefore, persons identified by the on-site Project Quality Control Manager will read and sign this worksheet as required.

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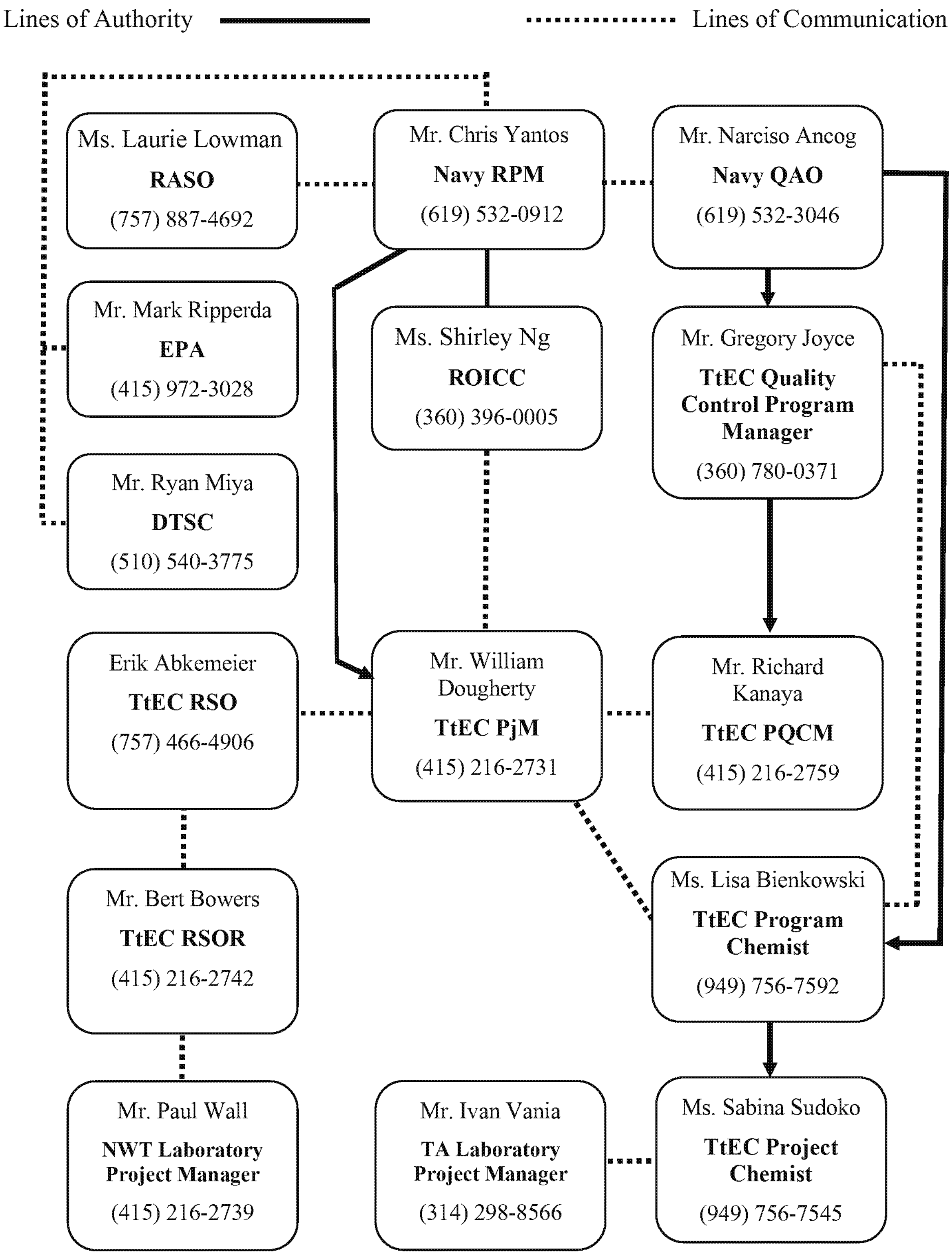
SAP Worksheet #5 – Project Organizational Chart



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SAP Worksheet #6 – Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Phone Number	Procedure
SAP approval	NAVFAC SW QAO	Mr. Narciso Ancog	(619) 532-3046	NAVFAC SW QAO will review and approve SAP. Field sampling will not begin without approved SAP.
Project management	Project Manager (PjM)	Mr. Bill Dougherty	(415) 216-2731	If changes are necessary, the PjM is responsible for communicating the changes via phone and/or e-mail to the project staffs and is authorized to stop work if necessary.
SAP review and radiological concurrence	RASO	Ms. Laurie Lowman	(757) 887-4692	The RASO will review and concur on the SAP as related to the radiological aspects of the site.
SAP review	Program Chemist	Ms. Lisa A. Bienkowski or Mr. Gregory Joyce	(949) 756-7592 (360) 598-8117	SAP will be reviewed by the Program Chemist (or QCPM) prior to submittal to the NAVFAC SW QAO.
Coordination of off-site laboratory supplies for field activities	Project Chemist	Ms. Sabina Sudoko	(949) 756-7545	The Project Chemist or designee will contact the off-site laboratory to provide all necessary sample containers and appropriate shipping materials (such as coolers and bubble wrap) to be delivered on-site prior to commencement of field sampling activities and throughout the course of the project.
Submittal of samples to the on-site laboratory	Sampling Personnel	TtEC	(415) 216-2739	Sampler will transfer samples to the on-site laboratory at the end of each day.
Daily COC reports and shipping documentation for off-site samples (radiological samples)	RSOR	Mr. Bert Bowers	(415) 216-2742	COCs and shipping documentation will be submitted via fax or e-mail to the Project Chemist at the end of each day that samples are collected for radiological analytes.
Daily COC reports and shipping documentation for off-site samples (nonradiological samples)	RSOR	Mr. Bert Bowers	(415) 216-2742	COCs and shipping documentation will be submitted via fax or e-mail to the Project Chemist at the end of each day that samples are collected for non-radiological analytes.

SAP Worksheet #6 – Communication Pathways (Continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number	Procedure
Reporting laboratory data quality issues	Laboratory Manager (on-site laboratory) Laboratory Project Manager (off-site laboratory)	Mr. Paul Wall Mr. Ivan Vania (Off-site Laboratory)	(415) 216-2739 (314) 298-8566 (Off-site Laboratory)	All QA/QC issues will be reported by the Laboratory Project Manager to the Project Chemist or PRSO in writing within 2 business days.
Field and analytical corrective actions	Project Chemist (off-site laboratory) RSOR (on-site laboratory)	Ms. Sabina Sudoko Mr. Bert Bowers	(949) 756-7545 (415) 216-2742	The Project Chemist or PRSO will immediately notify the PQCM, QCPM, Program Chemist, RASO, and RSO in writing of any field or analytical procedures not performed in accordance with this SAP. The Project Chemist or PRSO in coordination with the PQCM will complete documentation of the nonconformance and corrective actions to be taken. The Project Chemist or PRSO will verify that the corrective actions have been implemented.
Release of analytical data	Project Chemist (off-site laboratory) RSOR (on-site laboratory)	Ms. Sabina Sudoko Mr. Bert Bowers	(949) 756-7545 (415) 216-2742	The Project Chemist or PRSO will review data to verify that data quality objectives are met as described in this SAP prior to releasing the data. Analytical data will be released to the Project Manager (or their designee) after the Project Chemist or PRSO has verified that the data are in accordance the SAP requirements.
Review of radiological data and concurrence on radiological actions	RASO	Ms. Laurie Lowman	(757) 887-4692	The RASO will review all appropriate radiological data provided by the PRSO or designee and will concur on actions proposed by the PRSO.
SAP procedure revision during field activities	Project Chemist	Ms. Sabina Sudoko	(949) 756-7545	The Project Chemist or designee will prepare an FCR for any changes in sampling procedures that occur due to conditions in the field.
SAP amendments	Project Chemist	Ms. Sabina Sudoko	(949) 756-7545	Any changes to the SAP will require that the Project Chemist or designee prepare an addendum, which will be approved by NAVFAC SW QAO prior to any field activities.

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table

Name	Title/Role	Organizational Affiliation	Responsibilities
Mr. Narciso Ancog	QAO	NAVFAC SW	Reviewing and approving this SAP Providing Navy oversight of TtEC's Quality Assurance Program Providing technical and administrative oversight of TtEC's surveillance audit activities Acting as point of contact for matters concerning quality assurance and the Navy's Laboratory Quality Assurance Program Coordinating training on matters pertaining to generation and maintenance of quality of data Authorizing the suspension of project execution if quality assurance requirements are not adequately followed
Mr. Chris Yantos	RPM	NAVFAC SW	Performing project management for the DON Ensuring that the project scope of work requirements are fulfilled Overseeing the project cost and schedule Providing formal technical direction to the TtEC project team, as needed Acting as lead interface with agencies
Mr. Bill Dougherty	PjM	TtEC	Coordinating work activities of subcontractors and TtEC personnel, and ensuring that all personnel adhere to the administrative and technical requirements of the project Monitoring and reporting the progress of work, and ensuring that the project deliverables are completed on time and within project budget Monitoring the budget and schedule, and notifying the client and the RPM of any changes that may require administrative actions Ensuring adherence to the quality requirements of the contract, project scope of work, and the QC Plans Ensuring that all work meets the requirements of the technical specifications and complies with applicable codes and regulations Ensuring that all work activities are conducted in a safe manner in accordance with the Site-Specific Health and Safety Plan, United States Army Corps of Engineers' Safety and Health Requirements (EM-385-1-1), and all applicable OSHA regulations

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table (Continued)

Name	Title/Role	Organizational Affiliation	Responsibilities
Mr. Bill Dougherty (Continued)	PjM	TtEC	Serving as the primary contact between the DON and TtEC for actions and information related to the work and including appropriate TtEC technical personnel in the decision-making Coordinating satisfactory resolution and completion of evaluation and acceptance report for nonconformance reports
Ms. Laurie Lowman	Radiological Site Manager	RASO	Reviewing radiological laboratory data on a routine basis Reviewing and approving on-site laboratory SOPs for each type of analysis performed Performing on-site reviews of all radiological site operations including the on-site laboratory Reviewing and approving all radiological work plans and final reports Performing quality reviews on COCs to ensure samples are handled in accordance with the Work Plan and SAP Providing review and concurrence on data for proposed radiological actions Ensuring that all necessary sample results are provided and are consistent with proposed radiological actions Comparing radiological data with the requirements of the Work Plan, Design Plans, Task-specific Plans, and SAP to ensure that all proper conditions have been met to implement the action requested Ensuring that the radiological data reported are consistent with the intent for which the data were provided Comparing the sample number matrix with the intent of the data package to ensure that the sample number is consistent with the intent of the data package Reviewing sample acquisition information to ensure that the duration the sample was analyzed for meets the minimum required time necessary to meet the MDA Comparing each of the radionuclide's specific activity with the release criteria to ensure that the decision made is consistent with the specific activity reported Comparing the MDA with the release criteria to ensure that it is sufficiently below the release levels

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table (Continued)

Name	Title/Role	Organizational Affiliation	Responsibilities
Ms. Laurie Lowman (Continued)	Radiological Site Manager	RASO	Evaluating the qualifiers provided in the sample results to ensure that the information provided is consistent with the results provided Reviewing uncertainty counting and the 2 sigma total uncertainty data along with the laboratory qualifiers to determine if the data are of sufficient quality
Mr. Erik Abkemeier	Radiation Safety Officer	TtEC	Overseeing overall radiological operations and documentation for the project Supporting projects as the technical lead for radiological data collection and analysis Evaluating and selecting a qualified on-site laboratory Ensuring that Radiation Safety Office Representative and Project Radiation Safety Officer have adequate training in sample collection and analytical methods Monitoring performance of on-site radiological contractors Monitoring performance of on-site laboratory Ensuring that 10 percent of the samples are forwarded for off-site QA analysis Receiving and reviewing the QA sample data from the off-site laboratory to ensure the data quality objectives have been met
Mr. Bert Bowers	Radiation Safety Officer Representative	TtEC	Reviewing on-site laboratory data against requirements in this SAP prior to use Assessing on-site data to ensure that the quality of the data meets the intended use of the data Monitoring the gathering of field data by radiological technicians Ensuring that the field sampling requirements of this SAP are followed explicitly Assisting with implementation of this SAP as directed by the PRSO Providing day-to-day technical and administrative oversight of radiological operations Reviewing scan survey data prior to the data being sent to the PRSO for further review and evaluation and requiring additional scan data, as necessary Ensuring that all radiological detectors are functioning properly Performing sampling activities as directed by the PRSO Reviewing and evaluating static survey readings used to verify scan surveys or to get a reading of a sampling point

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table (Continued)

Name	Title/Role	Organizational Affiliation	Responsibilities
Mr. Bert Bowers (Continued)	Radiation Safety Officer Representative	TtEC	Performing periodic reviews of on-site laboratory operations Ensuring that all laboratory equipment is properly maintained and repaired Ensuring that laboratory supplies are available on-site and that expiration dates are observed
Mr. Daryl DeLong	Project Radiation Safety Officer	RSRS	Providing overall day-to-day, on-site radiological operations and document-preparation activities Reviewing on-site laboratory data against requirements in this SAP prior to use Assessing on-site data to ensure that the quality of the data meets the intended use of the data Reviewing and evaluating scan survey data and requiring additional scan data, as necessary Overseeing performance of radiological static surveys Identifying and assessing radiological contamination Concurring on the identification of elevated areas for collection of biased samples and the locations of systematic samples Overseeing the preparation of a remediation plan and the performance of remedial activities when sampling activities indicate the presence of radioactive materials at levels above the release criteria Directing any additional biased sampling activities to ensure the isolation and removal of radioactive material Reviewing and evaluating biased sampling data and identifying any additional radiological activities Recommending radiological activities to the RASO for concurrence including additional sampling, backfilling of trenches, identification of material that can be used as backfill, etc. Overseeing the plotting of systematic sample locations and collection of the appropriate number of samples Reviewing and evaluating static survey readings used to verify scan surveys or to get a reading of a sampling point Performing periodic on-site review of laboratory operations Reviewing sample data to ensure the appropriate information is included in the gamma spectroscopy reports

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table (Continued)

Name	Title/Role	Organizational Affiliation	Responsibilities
Mr. Daryl DeLong (Continued)	Project Radiation Safety Officer	RSRS	Consulting with the on-site Laboratory Manager regarding his assessment of the spectrum provided with the analyses and other issues Directing the on-site laboratory to analyze samples for longer periods to ensure the sample data results are correct, the MDA is below the release criteria, and/or the uncertainty is within tolerance, as appropriate Directing the on-site laboratory to perform additional types of analyses (i.e., ^{90}Sr or alpha spectroscopy) Comparing the laboratory results to the appropriate release criteria for the site Identifying samples to be forwarded to the off-site laboratory for QA purposes Reviewing the QA sample data from the off-site laboratory to ensure the data quality objectives have been met and requesting additional information, as necessary
Mr. Paul Wall	On-site Laboratory Manager	NWT	Providing day-to-day technical and administrative oversight of the on-site radiological laboratory Reviewing on-site laboratory sample results Developing and implementing on-site laboratory SOPs Reviewing sample counting results prior to sending the samples off-site Overseeing performance of gamma spectroscopy, ^{90}Sr, and alpha spectroscopy analyses for the on-site laboratory Ensuring that samples are properly prepared for the appropriate analysis in the on-site laboratory Ensuring that all detectors and equipment are properly maintained and calibrated, as necessary Overseeing the MDA calibration geometry, system and source-induced backgrounds, and detector resolution and ensuring that they are appropriate for each radionuclide Reviewing gamma spectroscopy analytical result reports to ensure that the MDAs are below the release criteria, that the counting uncertainties are within tolerance of the reported activity, and that the flags associated with each report represent a clear understanding of the associated reported activity for the isotope in question Verifying each analytical result by reviewing the spectrum file associated with each report

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SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table (Continued)

Name	Title/Role	Organizational Affiliation	Responsibilities
Mr. Paul Wall (Continued)	On-site Laboratory Manager	NWT	Ensuring that the electronic and hard copies of the analytical summary reports are delivered to TtEC for review Reviewing the QA sample data from the off-site laboratory to ensure that the data quality objectives have been met
Mr. Gregory Joyce	Quality Control Program Manager	TtEC	Establishing and maintaining the Quality Program Overseeing program QC, including construction and chemical data acquisition Working directly with the PjM and the DON to ensure implementation of the Program QC Plans Acting as a focal point for coordination for quality matters across all projects and resolving quality issues Suspending project activities if quality standards are not maintained Interfacing with the DON, including NAVFAC SW QAO, on quality-related items Conducting field QC audits to ensure project plans are being followed Performing reviews of audit and surveillance reports conducted by others Implementing the DON technical direction letters related to quality topics Approving any Field Change Requests or Addendums to the SAP
Ms. Lisa Bienkowski	Program Chemist	TtEC	Developing the SAP and any amendments to the SAP Implementing contract requirements for chemical data collection Supporting projects as the technical lead for chemical data collection and analysis Ensuring the Project Chemist has adequate training in analytical methodology Ensuring that sampling personnel have documented training on sampling procedures for specific project requirements Monitoring performance of subcontract laboratory and data validator

SAP Worksheet #7 – Personnel Responsibilities and Qualifications Table (Continued)

Name	Title/Role	Organizational Affiliation	Responsibilities
Ms. Sabina Suduko	Project Chemist	TtEC	Evaluating and selecting a qualified subcontract laboratory Reviewing laboratory data prior to use against requirements in this SAP Evaluating and selecting a qualified data validation subcontractor Reviewing data validation reports Preparing data quality assessment report to ensure the quality of the data meets the intended use of the data
Mr. Jon Karnath	Data Manager	TtEC	Uploading field information and laboratory data into the database Checking all data for completeness such that all required fields are entered and providing output to the project team in the format requested Submitting NEDD-formatted data to the DON in accordance with the requirements set forth in Environmental Work Instruction (EWI) EVR.6, Environmental Data Management and Required Electronic Delivery Standards (NAVFAC SW 2005)

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SAP Worksheet #8 – Special Personnel Training Requirements Table

Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates
Soil/sediment sampling	General employee radiological training	RSO, RSOR, PRSO or designee	Prior to field work	Sampling personnel	Sampler/TtEC	TtEC project file
Swipe sampling	On-site demonstration	RSOR or designee	Prior to sampling activities	Sampling personnel	Sampler/TtEC	TtEC Project file
VOC sampling (En Core and vials)	On-site demonstration	Project Chemist or designee	Prior to sampling activities	Sampling personnel	Sampler/TtEC	TtEC Project file
Sampling handling, documentation, and packaging procedures	On-site demonstration	Project Chemist or designee	Prior to sampling activities	Sampling personnel	Sampler/TtEC	TtEC Project file

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SAP Worksheet #9 – Project Scoping Session Participants Sheet

Worksheet #9 (Project Scoping Session Participants Sheet) is not applicable for this Revision 4 as the project scoping sessions were performed during the Preliminary Draft stages of the original SAP.

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SAP Worksheet #10 – Problem Definition

The main problem defined for this project is as follows: The DON has determined (based on the site-specific investigative data) that this site contains radioactive contamination in soils and storm/sanitary sewer system pipelines requiring a response action; therefore, the DON has initiated this removal action for the extraction of radiologically impacted sewer and storm drain piping and associated soil. This removal action will serve to substantially eliminate the potential threat posed by future migration and/or off-site release of radioactive material present at the site into the surrounding environment.

Prior radiological investigations have confirmed the presence of radium-226 (^{226}Ra) and cesium-137 (^{137}Cs) within the HPS storm drain and sanitary sewer line systems. The presence of other radionuclides, such as strontium-90 (^{90}Sr), will be assessed during the screening-process activities. Table A-1 provides the radiological remedial objectives (RROs) for these and other radionuclides of concern at HPS that have been established by the DON in consonance with the EPA, Region IX. The lateral piping associated with other radiologically impacted sites may impact the main drainage lines at HPS. Table A-2 identifies these sites and their associated isotopes of concern that may affect these specific drainage lines.

Chemical contamination at HPS will be addressed through the Installation Restoration Program (IRP) process, consistent with CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan. Table A-3 identifies the IRP sites located at HPS and their associated chemicals of concern.

BACKGROUND

HPS is located on a long promontory in the southeastern part of the City of San Francisco that extends east into San Francisco Bay. Presently, HPS encompasses approximately 848 acres, including approximately 416 acres on land. The land portion of HPS was purchased by the DON in 1939 and leased to Bethlehem Steel Corporation. At the start of World Was II in 1941, the DON took possession of the property and operated it as a shipbuilding, repair, and maintenance facility until 1974. The DON deactivated HPS in 1974. From 1976 to 1986, the DON leased HPS to Triple A Machine Shop, Inc., a private ship repair company that ceased operations in 1986. The DON resumed occupancy in 1989. In 1991, HPS was placed on the DON's Base Realignment and Closure list, and its mission as a DON shipyard ended in April 1994.

HPS was divided into six parcels, Parcels A through F. In November 2004, Parcel A was transferred to the City and County of San Francisco and, in that same year, the DON subdivided Parcel E, creating Parcel E-2. For over 20 years, the DON has leased many HPS buildings to private tenants and DON-related entities for industrial and artistic uses, including storage space, art studios, machine workshops, woodworking shops, automobile restoration garages, recreational vehicle parking, and the filming of movies. Most of these tenants are no longer leasing facilities at HPS.

SAP Worksheet #10 – Problem Definition (Continued)

System Description

The present-day configuration of the sanitary and stormwater sewer system is the result of an evolutionary process. This system was originally designed and built in the 1940s as a combined system, using the same conveyance piping and 40 separate discharge outfalls into the bay. This combined system grew in sections from the 1940s to its maximum size in 1958, when it underwent the first in a series of separation projects. The Building 819 pump station was constructed for conveyance of much of the sanitary sewage from HPS to the City of San Francisco treatment works, and separation of the systems took place in the industrial areas and the southwest area of HPS.

Separation of the systems involved installation of dedicated sanitary sewer collection piping or diversion structures within the combined system. Twenty-eight bay outfalls were converted for exclusive use for stormwater outlets, while 12 continued to serve as combined sanitary and stormwater sewer outlets. In 1973, the second segregation project was undertaken. This project removed some of the stormwater outfalls from the South Basin Area, just offshore from the Parcel E shoreline. The last of the separation projects performed in 1976 involved the installation of additional dedicated sanitary sewer piping. Complete separation of the combined systems was never achieved. All components of the storm and sanitary sewer systems in Parcels B, C, D, E, and E-2 are considered impacted as documented in the final Historical Radiological Assessment (HRA) (NAVSEA 2004).

Where information is available, the storm drain system at HPS appears to be constructed of vitrified clay, cast iron, and corrugated metal pipes. Similar materials are likely present in portions of the storm drain system where information is not available. Typically, the major conveyance routes follow streets, but this is not always the case, and diameter increases as the drainage area increases in size. This system starts as small as 6 inches and increases to 39 inches or larger. Secondary collection systems are dispersed throughout the area and vary from 4 inches to 12 inches. These secondary systems connect with the major routes or directly into an outfall for smaller isolated areas.

The majority of the sanitary sewer lines at HPS range in diameter from 2 inches to 33 inches. Line materials appear to be primarily concrete, vitreous clay, and cast iron but other piping types also may be present. Main sanitary sewer lines at HPS include the Crisp Road and Spear Avenue lines. The major conveyance lines coincide with the same routing of the storm drain system along McCann, English, and Lockwood streets and under Building 134 and east of Building 130. Secondary sewer lines connect the buildings, piers, and berths with the major lines.

SCOPE

The general approach to removing and radiologically surveying the storm drain and sewer lines includes 1) excavating soils; 2) removing the pipeline system components; 3) plugging the open storm drain and sewer lines left in place during the removal process to prevent water from

SAP Worksheet #10 – Problem Definition (Continued)

entering or exiting pipes; 4) conducting ex situ radiological screening and sampling of the excavated soil and pipeline system components; and 5) conducting Final Status Surveys (FSSs) of the excavated soil and exposed excavation trench surfaces. After the results of these activities are evaluated and any identified radiological contamination is removed, the trench excavations will be backfilled and the site restored.

The term "piping" includes all storm drain and sanitary sewer piping and system components that may be encountered during this removal action. The majority of the known storm drain and sanitary sewer piping at HPS will be removed; however, limited piping specified below will be left in place permanently, or will be addressed at a later date:

- Piping under the footprint of radiologically impacted buildings and outdoor areas will be evaluated using the radionuclide of concern specific to the building (within 10 feet), and may be handled under this Work Plan.
- Piping laterals originating at non-radiologically impacted buildings will initially only be removed within the first 10 feet of their union with a main trunk line. If no radiological contamination is present in this segment of the line, then the exposed ends of the lateral will be capped or plugged and the remaining portions left in place. If evidence of radiological contamination is encountered, the remaining lateral will be removed in 10-foot sections until the line has been determined to be free of radioactive contamination or to the face of an existing building, whichever comes first.

Excavated soil overlying each storm and sanitary sewer line will be removed to a minimum of 1 foot below and around the pipeline and will be radiologically surveyed and sampled for unrestricted use. When this soil is excavated from within an identified IRP site, it will be stockpiled and sampled for the chemicals of concern prior to making a decision to either use the soil for trench backfill or dispose of the soil as waste. Excavated soil from non-IRP sites will be stockpiled separately and used to backfill the excavations without additional chemical testing.

After the excavated soil is removed and stockpiled, the pipelines will be removed. To the extent practicable, the pipeline materials will be removed separately. The interior and exterior surfaces of removed piping will be radiologically characterized by hand survey and sampling. Solid/sediment samples will be collected and analyzed for radiological contamination if sufficient amounts are found to be present within the removed section of pipe. If the piping cannot be extracted separately, as in the case of terracotta pipe, it will be managed as Excavated Soil (ES).

FSSs for every excavated trench section and excavated soil will include 100 percent scan measurements. FSS results will be used for dose modeling and unrestricted release. Should radioactive material be detected within the trench or in the excavated soil, it will be removed and additional surveys/sampling will be performed.

SAP Worksheet #10 – Problem Definition (Continued)

When the results of the surveys and sampling confirm that contamination above the RROs has been removed, the excavation trenches will be backfilled upon concurrence from the RASO. The primary source of backfill material is expected to be uncontaminated material removed from the excavations.

Radioactively contaminated material (system components, debris, excavated soils including mixed wastes, and incidental material) exhibiting concentrations above the RROs will be properly stored on-site pending packaging, disposal, and transportation by the Army contractor in compliance with the DON's Low-Level Radioactive Waste (LLRW) Disposal Program (SWDIV 2001b). Soils excavated from within IRP sites not deemed suitable for reuse as backfill will be sent for off-site disposal. Large nonradioactive debris not suitable for replacement within the excavation area also will be sent for off-site disposal.

SAP Worksheet #10 – Problem Definition (Continued)

TABLE A-2
BUILDING/AREA ASSESSMENT AND CLASSIFICATION AND ASSOCIATED ISOTOPES OF CONCERN

	Contamination Potential					Contaminated Media							Potential Migration Pathways								
Building No. or Area	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System	Recommended Actions	Isotopes of Concern
PARCEL B																					
103				✓		N	N	N	N	N	L	L	N	N	N	N	N	L	N	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, and ^{90}Sr
113				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, and ^{90}Sr
113A				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	^{137}Cs and ^{226}Ra
114				✓		L	N	N	N	N	N	N	L	N	N	N	N	N	N	Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
130				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	^{137}Cs and ^{226}Ra
140 and Discharge Channel				✓		N	N	N	N	N	L	L	N	N	N	N	N	L	L	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
142				✓		L	N	N	N	N	L	N	L	N	N	N	N	L	N	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
146			✓			N	N	N	N	N	L	N	N	N	N	N	N	L	N	Characterization Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr

SAP Worksheet #10 – Problem Definition (Continued)

	Contamination Potential					Contaminated Media							Potential Migration Pathways								
Building No. or Area	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System	Recommended Actions	Isotopes of Concern
157				✓		**N**	**N**	**N**	**N**	**N**	**L**	**N**	**N**	**N**	**N**	**N**	**N**	**L**	**N**	Scoping Survey	^{60}Co, ^{137}Cs, and ^{226}Ra
IR-07				✓		**L**	**L**	**N**	**N**	**N**	**N**	**N**	**L**	**L**	**N**	**N**	**N**	**N**	**N**	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
IR-18				✓		**L**	**L**	**N**	**N**	**N**	**N**	**N**	**L**	**L**	**N**	**N**	**N**	**N**	**N**	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
Drydock 5				✓		**N**	**N**	**N**	**N**	**N**	**L**	**L**	**N**	**N**	**N**	**N**	**N**	**L**	**L**	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
Drydock 6				✓		**N**	**N**	**N**	**N**	**N**	**L**	**L**	**N**	**N**	**N**	**N**	**N**	**L**	**L**	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
Drydock 7				✓		**N**	**N**	**N**	**N**	**N**	**L**	**L**	**N**	**N**	**N**	**N**	**N**	**L**	**L**	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
PARCEL C																					
203				✓		**L**	**N**	**N**	**N**	**N**	**L**	**N**	**L**	**N**	**N**	**N**	**N**	**L**	**N**	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
205 and Discharge Channel				✓		**N**	**N**	**N**	**N**	**N**	**L**	**L**	**N**	**N**	**N**	**N**	**N**	**L**	**L**	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
211		✓				**N**	**N**	**N**	**N**	**N**	**M**	**L**	**N**	**N**	**N**	**N**	**N**	**L**	**L**	Remediation and Final Status Survey	^{137}Cs, ^{226}Ra, and ^{232}Th
214				✓		**N**	**N**	**N**	**N**	**N**	**L**	**N**	**N**	**N**	**N**	**N**	**N**	**L**	**N**	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr

SAP Worksheet #10 – Problem Definition (Continued)

	Contamination Potential					Contaminated Media							Potential Migration Pathways								
Building No. or Area	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System	Recommended Actions	Isotopes of Concern
224			✓			N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, and ^{90}Sr
241				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	NORM
253		✓				N	N	N	N	N	H	H	N	N	N	N	N	M	M	Remediation and Final Status Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{232}Th
271				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	^{226}Ra
272				✓		N	N	N	N	N	L	N	N	N	N	N	N	L	N	Review Final Status Survey Report	^{60}Co, ^{137}Cs, and ^{226}Ra
Drydock 2			✓			N	N	N	N	N	M	L	N	N	N	N	N	L	L	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
Drydock 3			✓			N	N	N	N	N	M	L	N	N	N	N	N	L	L	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
Drydock 4			✓			N	N	N	N	N	M	L	N	N	N	N	N	L	L	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr

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SAP Worksheet #10 – Problem Definition (Continued)

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
PARCEL D																					
274				✓		**N**	**N**	**N**	**N**	**N**	**L**	**N**	**N**	**N**	**N**	**N**	**N**	**L**	**N**	Review Final Status Survey Report	^{137}Cs, ^{226}Ra, and ^{90}Sr
313 Site			✓			**L**	**L**	**N**	**N**	**N**	**N**	**N**	**L**	**L**	**N**	**N**	**N**	**N**	**N**	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{232}Th
313A Site			✓			**M**	**L**	**N**	**N**	**N**	**N**	**M**	**L**	**L**	**N**	**N**	**N**	**N**	**L**	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{232}Th
317 Site			✓			**L**	**L**	**N**	**N**	**N**	**N**	**N**	**L**	**L**	**N**	**N**	**N**	**N**	**N**	Review Final Status Survey Report	^{137}Cs, ^{226}Ra, and ^{90}Sr
322 Site			✓			**L**	**N**	**N**	**N**	**N**	**N**	**N**	**L**	**N**	**N**	**N**	**N**	**N**	**N**	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{232}Th
351			✓			**N**	**N**	**N**	**N**	**N**	**M**	**L**	**N**	**N**	**N**	**N**	**N**	**L**	**L**	Review Final Status Survey Report	^{137}Cs, ^{226}Ra, ^{90}Sr, and ^{232}Th
351A		✓				**M**	**N**	**N**	**N**	**N**	**M**	**M**	**M**	**N**	**N**	**N**	**N**	**L**	**L**	Characterization Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{232}Th
364		✓				**H**	**M**	**N**	**N**	**N**	**H**	**H**	**M**	**L**	**N**	**N**	**N**	**M**	**M**	Remediation and Final Status Survey	^{60}Co, ^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{235}U

SAP Worksheet #10 – Problem Definition (Continued)

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
365				✓		**N**	**N**	**N**	**N**	**N**	**L**	**L**	**N**	**N**	**N**	**N**	**N**	**L**	**L**	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{235}U
366/351B		✓				**N**	**N**	**N**	**N**	**N**	**M**	**M**	**N**	**N**	**N**	**N**	**N**	**L**	**L**	Remediation and Final Status Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
383				✓		**N**	**N**	**N**	**N**	**N**	**L**	**N**	**N**	**N**	**N**	**N**	**N**	**L**	**N**	Review Final Status Survey Report	^{3}H, ^{226}Ra, and ^{90}Sr
408			✓			**N**	**N**	**N**	**N**	**N**	**M**	**N**	**N**	**N**	**N**	**N**	**N**	**L**	**N**	Scoping Survey	^{226}Ra
411				✓		**N**	**N**	**N**	**N**	**N**	**L**	**N**	**N**	**N**	**N**	**N**	**N**	**L**	**N**	Review Final Status Survey Report	^{60}Co, ^{137}Cs, and ^{226}Ra
Gun Mole (Regunning) Pier			✓			**L**	**L**	**N**	**N**	**N**	**L**	**N**	**L**	**L**	**N**	**N**	**N**	**L**	**N**	Review Characterization Report	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
500				✓		**N**	**N**	**N**	**N**	**N**	**L**	**N**	**N**	**N**	**N**	**N**	**N**	**L**	**N**	Scoping Survey	^{137}Cs and ^{226}Ra
503 Site			✓			**N**	**L**	**N**	**N**	**N**	**N**	**L**	**N**	**L**	**N**	**N**	**N**	**N**	**L**	Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
Mahan Street-NRDL			✓			**M**	**M**	**N**	**N**	**N**	**N**	**N**	**L**	**L**	**N**	**N**	**N**	**N**	**N**	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
813				✓		**N**	**N**	**N**	**N**	**N**	**L**	**N**	**N**	**N**	**N**	**N**	**N**	**L**	**N**	Scoping Survey	^{90}Sr

SAP Worksheet #10 – Problem Definition (Continued)

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
819			✓			**N**	**N**	**N**	**N**	**N**	**L**	**M**	**N**	**N**	**N**	**N**	**N**	**L**	**M**	Scoping Survey	^{137}Cs and ^{226}Ra
PARCEL E																					
406			✓			**N**	**N**	**N**	**N**	**N**	**M**	**N**	**N**	**N**	**N**	**N**	**N**	**L**	**N**	Review Final Status Survey Report	^{137}Cs and ^{226}Ra
414				✓		**N**	**N**	**N**	**N**	**N**	**L**	**N**	**N**	**N**	**N**	**N**	**N**	**L**	**N**	Review Final Status Survey Report	^{226}Ra
500 Building Series			✓			**M**	**H**	**N**	**N**	**N**	**N**	**H**	**L**	**M**	**N**	**N**	**N**	**N**	**H**	Scoping Survey	^{241}Am, ^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
506 Site			✓			**M**	**M**	**N**	**N**	**N**	**N**	**M**	**L**	**L**	**N**	**N**	**N**	**N**	**M**	Scoping Survey	^{241}Am, ^{137}Cs, ^{3}H, ^{239}Pu, ^{226}Ra, and ^{90}Sr
507 Site			✓			**L**	**L**	**N**	**N**	**N**	**N**	**M**	**L**	**L**	**N**	**N**	**N**	**N**	**L**	Characterization Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
508 Site			✓			**L**	**L**	**N**	**N**	**N**	**N**	**M**	**L**	**L**	**N**	**N**	**N**	**N**	**L**	Characterization Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
509 Site			✓			**L**	**L**	**N**	**N**	**N**	**N**	**M**	**L**	**L**	**N**	**N**	**N**	**N**	**L**	Characterization Survey	^{137}Cs and ^{90}Sr
510 Site			✓			**L**	**L**	**N**	**N**	**N**	**N**	**M**	**L**	**L**	**N**	**N**	**N**	**N**	**L**	Characterization Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
510A Site			✓			**L**	**L**	**N**	**N**	**N**	**N**	**M**	**L**	**L**	**N**	**N**	**N**	**N**	**L**	Scoping Survey	^{137}Cs and ^{90}Sr

SAP Worksheet #10 – Problem Definition (Continued)

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
517 Site			✓			L	L	N	N	N	N	M	L	L	N	N	N	N	L	Characterization Survey	^{60}Co, ^{137}Cs, and ^{90}Sr
520 Site		✓				M	M	N	N	N	N	M	M	M	N	N	N	N	L	Characterization Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
521				✓		L	N	N	N	N	L	N	N	N	N	N	N	N	N	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
529 Site		✓				M	M	N	N	N	M	H	L	L	N	N	N	L	M	Scoping Survey	^{137}Cs, ^{3}H, ^{226}Ra, and ^{90}Sr
701 Site				✓		L	N	N	N	N	N	N	L	N	N	N	N	N	N	Review Final Status Survey Report	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
704 Area			✓			L	L	N	N	N	N	N	L	L	N	N	N	N	N	Scoping Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
704/Pens				✓		L	L	N	N	N	N	N	L	L	N	N	N	N	N	Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
707/Kennels		✓				L	L	N	N	N	L	M	L	L	N	N	N	L	M	Characterization Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
707 B Site				✓		L	L	N	N	N	N	N	N	L	N	N	N	N	L	Characterization Survey (as part of 707 Triangle Area Survey)	^{137}Cs, ^{226}Ra, and ^{90}Sr
707 C Site				✓		L	L	N	N	N	N	N	L	L	N	N	N	N	N	Characterization Survey as (part of 707 Triangle Area Survey)	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr

SAP Worksheet #10 – Problem Definition (Continued)

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
707 Triangle Area		✓				L	H	N	N	N	N	H	L	M	N	N	N	N	M	Characterization Survey	^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{235}U
708				✓		L	N	N	N	N	L	N	L	N	N	N	N	N	N	Review Final Status Survey Report	^{137}Cs and ^{90}Sr
719 Site				✓		L	L	N	N	N	N	N	L	N	N	N	N	N	N	Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
807 Site				✓		L	L	N	N	N	N	N	L	L	N	N	N	L	N	Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
810		✓				M	N	N	N	N	M	N	L	N	N	N	N	L	N	Remediation and Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
Shack 79 Site			✓			M	L	N	N	N	N	N	L	L	N	N	N	N	N	Final Status Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
Shack 80 Site		✓				H	M	N	N	N	N	N	M	L	N	N	N	N	N	Remediation and Final Status Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
Experimental Shielding Range			✓			M	L	N	N	N	N	N	L	L	N	N	N	N	N	Review Final Status Survey Report	^{60}Co, ^{137}Cs, and ^{226}Ra
IR-01/21, Industrial Landfill		✓				H	H	N	N	N	N	N	M	M	N	N	N	N	N	Review Characterization Survey Report, Remediation, and Final Status Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
IR-02, Bay Fill		✓				H	H	N	L	N	N	N	M	M	N	L	N	N	N	Characterization Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr

SAP Worksheet #10 – Problem Definition (Continued)

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
IR-03			✓			**M**	**M**	**N**	**N**	**N**	**N**	**N**	**L**	**L**	**N**	**N**	**N**	**N**	**N**	Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
IR-04		✓				**H**	**M**	**N**	**N**	**N**	**N**	**N**	**M**	**L**	**N**	**N**	**N**	**N**	**N**	Characterization Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
Former Salvage Yard			✓			**M**	**M**	**N**	**N**	**N**	**N**	**N**	**L**	**L**	**N**	**N**	**N**	**N**	**N**	Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
Shoreline		✓				**H**	**M**	**L**	**N**	**N**	**N**	**N**	**M**	**M**	**L**	**N**	**N**	**N**	**N**	Characterization Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr
BASE-WIDE																					
Storm Drain lines		✓				**N**	**L**	**N**	**N**	**N**	**L**	**H**	**N**	**L**	**N**	**N**	**N**	**L**	**M**	Scoping/Characterization Surveys of systems associated with NRDL sites or sites associated with radium use	^{137}Cs, ^{226}Ra, and ^{90}Sr
Sanitary Sewers		✓				**N**	**L**	**N**	**N**	**N**	**L**	**H**	**N**	**L**	**N**	**N**	**N**	**L**	**M**	Scoping/Characterization Survey of systems associated with NRDL sites or sites associated with radium use	^{137}Cs, ^{226}Ra, and ^{90}Sr
Septic Systems			✓			**N**	**M**	**N**	**N**	**N**	**N**	**H**	**N**	**L**	**N**	**N**	**N**	**N**	**M**	Scoping/Characterization Surveys of systems associated with NRDL buildings	^{137}Cs, ^{226}Ra, and ^{90}Sr

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SAP Worksheet #10 – Problem Definition (Continued)

Building No. or Area	Contamination Potential					Contaminated Media							Potential Migration Pathways							Recommended Actions	Isotopes of Concern
	Known-restricted Access	Known-continued Access	Likely	Unlikely	Unknown	Surface Soil	Subsurface Soils	Surface Water	Groundwater	Air	Structures	Drainage System	Surface Soil	Subsurface Soil	Surface Water	Groundwater	Air	Structures	Drainage System		
PARCEL F																					
Underwater Areas			✓			**N**	**L**	**N**	**N**	**N**	**N**	**N**	**L**	**N**	**N**	**N**	**N**	**N**	**N**	Scoping Surveys in areas of Operation CROSSROADS decontamination activities and site outfall discharge	^{137}Cs, ^{239}Pu, ^{226}Ra, ^{90}Sr, and ^{235}U
All Ships' Berths				✓		**L**	**L**	**N**	**N**	**N**	**L**	**N**	**N**	**L**	**N**	**N**	**N**	**L**	**N**	Review Final Status Survey Report for completed berths; Scoping Survey on remainder	^{137}Cs, ^{239}Pu, ^{226}Ra, and ^{90}Sr
OFF-SITE FACILITY																					
ICW 418				✓		**N**	**N**	**N**	**N**	**N**	**L**	**N**	**N**	**N**	**N**	**N**	**N**	**L**	**N**	Scoping Survey	^{137}Cs, ^{226}Ra, and ^{90}Sr

Notes:

H High = Evidence of contamination in the media or migration pathway has been identified.
L Low = The potential for contamination in the type of media or migration pathway is remote.
M Moderate = The potential for contamination in the media or migration pathway exists, although the extent has not been fully assessed.
N None = Evidence of contamination in the specific media or migration pathway has not been found, or known contamination has been removed, and surveys indicate that the media or migration pathway meets today's release criteria.

SAP Worksheet #10 – Problem Definition (Continued)

TABLE A-3
HPS IRP SITE CHEMICALS OF CONCERN

Site	Area	VOCs	SVOCs	Pesticides	PAHs	PCBs	TOG	TPH	TPH-d	TPH-g	TPH-E	TPH-P	TPH-MO	WO	TRPH	CN	Metals
	PARCEL B																
IR-07	Sub-Base Area				S		S		S								S/GW
IR-10	Battery & Electroplating Shop	S	S/GW	S	S/GW	S	S/GW		S/GW	S					S		S/GW
IR-18	Waste Oil Disposal Area	S/GW	S	S	GW	S	S/GW		S	S							S/GW
IR-20	Building 156	S/GW	S		GW	S/GW	S		S	S							S/GW
IR-23	Bldgs. 145, 146, 161, 162, UST	S	S/GW	S	S	S		GW	S		S		S	S			S
IR-24	Bldgs. 124, 125, 128, 130	S/GW	S		GW	S	S/GW		S/GW	S	S/GW	S/GW					S/GW
IR-26	Bldg. 157, area north of Dry Dock 3	S			S	S	S			S	S	S					S/GW
SI-31	Building 114				S												S
IR-42	Bldgs. 109, 113, 113A			S	S	S	S				S		S				S
IR-60	Drydocks 5, 6, 7	S	S					S									S/GW
IR-61	Substation V/ Building 122		S/GW			S/GW		S/GW									
IR-62	Bldgs. 115 and 116, UST		S/GW			S/GW		S/GW									
	PARCEL C																
IR-06	Tank Farm	S/GW	S/GW		S	S	S		S/GW	S							S/GW
IR-25	Building 134	S/GW	GW	GW	S	S	S	GW	S		S	S	S				S/GW
IR-27	Bldg. 205, USTs		S				S		S	S							S

SAP Worksheet #10 – Problem Definition (Continued)

Site	Area	VOCs	SVOCs	Pesticides	PAHs	PCBs	TOG	TPH	TPH-d	TPH-g	TPH-E	TPH-P	TPH-MO	WO	TRPH	CN	Metals
IR-28	Bldgs. 211/253, 219, 229, 230, 231, 258, 270, 271, 273, 281, USTs	S/GW	S/GW	S/GW	S/GW	S	S/GW		S/GW	S/GW		S/GW	S				S/GW
IR-29	Bldgs. 203, 217, 275, 279, 280, 282, USTs	S/GW	S/GW	S/GW	S	S	S	GW	S		S	S					S/GW
IR-30	Building 241	S/GW	S/GW	S/GW	S/GW	GW	S/GW	GW	S/GW		S/GW	S				S/GW	S/GW
IR-57	Drydock 4 Area	S	S			S	S		S					S			S
IR-58	Scrap Yard north of Bldg. 258	S/GW	S/GW	S	S	S	S	GW	S		S	S					S/GW
IR-63	Former Building 278		S			S		S									S
IR-64	Building 206	S/GW	S					S/GW									S/GW
	PARCEL D																
IR-08	PCB Spill Area (Bldg. 503)	S/GW	S/GW	S	S/GW	S/GW	S		S								S/GW
IR-09	Pickling and Plate Yard	S/GW	GW	S	S/GW				S								S/GW
IR-16	Container Storage Area					GW		GW									S/GW
IR-17	Drum Storage and Disposal Area	S/GW			S		S/GW										S
IR-22	Buildings 368, 369, UST	S/GW	S	S	S/GW	S	S/GW		S		S						S/GW
SI-32	Building 383, Regunning Pier	GW	S		S		S		S							S	S/GW

SAP Worksheet #10 – Problem Definition (Continued)

Site	Area	VOCs	SVOCs	Pesticides	PAHs	PCBs	TOG	TPH	TPH-d	TPH-g	TPH-E	TPH-P	TPH-MO	WO	TRPH	CN	Metals
IR-33	Bldgs. 302, 302A, 304, 364, 365, 411, 417, 418, 424, UST	S	S	S	S	S	S	GW	S	S	S		S			S	S/GW
IR-34	Bldgs. 351, 366	S/GW	S	S	S	S	S	GW	S				S				S/GW
IR-35	Bldgs. 274, 306, 313, 313A, 322, 372, area bounded by Manseau, Morell, and E Streets	S/GW		S	S	S	S	GW			S	S	S				S/GW
IR-37	Bldgs. 401, 423, 435, 436, 437, UST		S/GW					GW									S/GW
SI-38	Building 500, UST		S				S	GW	S	S							S/GW
IR-39	Building 505	S/GW	S		S	S	S	GW	S	S	S						S/GW
IR-44	Area near Bldgs. 408, 409, 410, 438	S/GW	S/GW					S/GW									S/GW
IR-53	Bldgs. 525, 530	S/GW	S/GW	S	S	S/GW	S	GW	S	S	S						S/GW
IR-55	Building 307 and surrounding area	S	S	S	S	S	S	S/GW	S		S	S					S/GW
IR-65	Building 324					S/GW											
IR-66	Building 407		S/GW					S/GW									S/GW
IR-67	Building 439	S	S					S/GW									S
IR-68	Building 378					GW		S/GW									
IR-69	Building 523, metal shed near Building 523					S		S									S/GW

SAP Worksheet #10 – Problem Definition (Continued)

Site	Area	VOCs	SVOCs	Pesticides	PAHs	PCBs	TOG	TPH	TPH-d	TPH-g	TPH-E	TPH-P	TPH-MO	WO	TRPH	CN	Metals
IR-70	Area northeast of S-308	S/GW	S/GW					S/GW									S/GW
IR-71	Crane Area							S/GW									
	PARCEL E																
IR-1/21	Industrial Landfill	S/GW	S/GW			S/GW			S/GW	S/GW							S/GW
IR-02	Bay Fill	S/GW	S/GW	S		S/GW	S		S/GW	S/GW					S/GW		S/GW
IR-03	Oil Reclamation Ponds	S/GW	S/GW	GW	S	S/GW	S		S/GW		S				S		S/GW
IR-04	Scrap Yard	S/GW	S		S	S	S/GW		S/GW	S/GW							S/GW
IR-05	Old Transformer Storage Yard	S/GW	S	S	S/GW	S/GW	S		S/GW	S		GW					S/GW
IR-11	Building 521, Power Plant Area	S/GW	S	S		S	S		S/GW	S							S
IR-12	Disposal Trench Area	S/GW	S/GW	S	S	S/GW	S/GW		S/GW	S/GW	S		S			S	S/GW
IR-13	Old Commissary Area	S	S/GW			S	S/GW		S	S	GW						S
IR-14	Oily Liquid Waste Disposal Area	S	S	S			S/GW		S/GW	S/GW					S		S/GW
IR-15	Oily Waste Ponds and Incineration Tank	S/GW	S/GW	S	GW	GW	S/GW		S/GW	S/GW							S/GW

SAP Worksheet #10 – Problem Definition (Continued)

Site	Area	VOCs	SVOCs	Pesticides	PAHs	PCBs	TOG	TPH	TPH-d	TPH-g	TPH-E	TPH-P	TPH-MO	WO	TRPH	CN	Metals
IR-36	Bldgs. 371, 400, 404A, 405, 406, 413, 414, 704, 710, parts of Area IV, UST	S/GW	S/GW	S/GW	S	S	S/GW		S/GW	S/GW		S	S/GW				S/GW
SI-38	Bldgs. 506, 507, 509, 510, UST	S					S		S	S							S/GW
IR-39	Building 707						S		S							GW	S/GW
IR-40	Building 527, Pier 2	S	S			S	S		S	S							S
IR-52	Railroad Right-of-Way	S		S		S	S		S	S							S
SI-54	Building 511A			S	S	S	S		S	S					S		S
IR-56	Railroad Tracks and yard south of Crisp Ave.	S/GW	S		S		S	GW									S/GW
IR-72	Building 810 Area, UST	S/GW	S/GW					S/GW									S
IR-73	Asphalt Batch Plant	S/GW	S/GW					S/GW									
IR-74	Building 815 (FUDS)		S					S									
IR-75	Building 820 (FUDS)	GW						S/GW									S/GW
IR-76	Area surrounding Bldgs. 830 and 831	GW	S/GW	S/GW		S		S/GW									S/GW

SAP Worksheet #10 – Problem Definition (Continued)

Site	Area	VOCs	SVOCs	Pesticides	PAHs	PCBs	TOG	TPH	TPH-d	TPH-g	TPH-E	TPH-P	TPH-MO	WO	TRPH	CN	Metals
	PARCEL F																
IR-78	Subtidal Area				S	S		S									S
	UTILITY SITES**																
IR-45	Steam Lines	S	S	S	S	S	S		S	S							S
IR-46	Fuel Distribution Lines (Tank Farm)	S	S	S	S	S	S		S/GW		S	S			S		S
IR-47	Fuel Distribution Lines (Tank S-505)	S		S		S	S		GW		S	S					S
IR-48	Suspected Steam Lines (Building 503) No Found																
IR-49	Fuel Distribution Lines (Bldgs. 203, 205)	S	S	S	S	S	S		GW		S	S			S		S
IR-50	Storm Drains and Sanitary Sewers	S/GW	S		S/GW	S			S	S/GW	S				S	S	S/GW
IR-51	Former Transformer Locations					S											

Notes:

** Facility-wide sites (Parcels A through E only)
GW Groundwater
S Soil

SAP Worksheet #11 – Project Quality Objectives/Systematic Planning Process Statements

The data quality objectives (DQOs) specify the project objectives, the data collection boundaries and limitations, the most appropriate type of data to collect, and the level of acceptable decision error. The quality and quantity of data required to implement an environmental remedial action are also defined.

The project-specific DQOs, as defined through the seven-step process (EPA 2006a), are as follows:

1. State the problem

The main problem defined for this project is as follows: The DON has determined (based on the site-specific investigative data) that this site contains radioactive contamination in soils and storm/sanitary sewer system pipelines requiring a response action; therefore, the DON has initiated this removal for the extraction of radiologically impacted sewer and storm drain piping and associated soil. This removal action will serve to substantially eliminate the potential threat posed by future migration and/or off-site release of radioactive material present at the site into the surrounding environment.

2. Identify the goal of the study

a. Is radioactivity detected above background plus 3 sigma in the soil during gamma scans?
b. Is ^{226}Ra detected at 1.0 picocurie per gram (pCi/g) above background in postexcavation samples?
c. Is ^{137}Cs detected at or above 0.113 pCi/g in postexcavation samples?
d. Is ^{90}Sr detected at or above 0.331 pCi/g in postexcavation samples?
e. Are any other radioisotopes detected above the RROs established in the Action Memorandum (AM)?
f. Does the import material meet screening levels listed in Worksheet #15?

3. Identify information inputs

The background concentration of ^{226}Ra, ^{137}Cs, and ^{90}Sr will be determined during this project. A geophysical survey may be performed to locate the pipelines. Available historical drawings of the storm/sanitary sewer system will be reviewed and will guide the extraction activities.

Radiological surveys required to support the unrestricted release of trenches and excavated soil are to include 1) 100 percent gamma scan surveys, 2) systematic and biased soil sampling of the Class 1 survey units, and 3) laboratory data review and statistical analysis of collected data.

A minimum of 18 postexcavation samples will be collected at systematic soil sampling locations throughout the trench and from each excavated soil screening pad in the Radiological Screening Yard (RSY). At least one sediment sample will be collected from piping that contains a sufficient

SAP Worksheet #11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

quantity of material, and swipe samples will be collected from piping. Postexcavation samples will be analyzed by gamma spectroscopy.

The review and acceptance of backfill material will be performed in accordance with SOP HPO-Tt-027 (DCN: FWSD-RAC-06-0764). Import material samples will be collected from each source and analyzed prior to use for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), total purgeable petroleum hydrocarbons (TPH-purgeable), total extractable petroleum hydrocarbons (TPH-extractable), metals, and gamma-emitting isotopes.

4. Define the boundaries of the study

The 848-acre site includes about 416 acres on land that contains the majority of the suspect radiologically contaminated storm and sanitary sewer system pipelines at HPS, which was divided into six parcels, Parcels A through F. In 2004, Parcel E was subdivided, creating Parcel E-2. Parcel A was transferred in December 2004.

The spatial boundaries for the FSS effort are confined to the radiologically impacted sanitary sewer and storm drain systems. The release limits for this survey are listed in Table A-1.

Readings greater than background plus 3 sigma or sample results that exceed the release limits will be further investigated to identify the extent of the contamination.

Design plans will be prepared for each parcel or area as dictated by the DON, and each design plan will include a project schedule as well as figures showing the boundaries of the pipeline removal activities.

This is an ongoing project expected to extend over many years with multiple contracting vehicles.

5. Develop the analytic approach

a. If activity of radiation is reported at background plus 3 sigma for soil during gamma scans, then removal of the area and additional surveys and sampling will continue as necessary to support the removal action goals until otherwise directed by the DON and RASO. Otherwise, no further action will be required.

b. If ^{226}Ra is reported 1.0 pCi/g above the background concentration for postexcavation samples, then excavation of the area and additional surveys and sampling will continue as necessary to support the removal action goals until otherwise directed by the DON and RASO. Otherwise, no further action will be required.

c. If ^{137}Cs is reported at 0.113 pCi/g or above for postexcavation samples, then excavation of the area and additional surveys and sampling will continue as necessary

SAP Worksheet #11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

to support the removal action goals until otherwise directed by the DON and RASO. Otherwise, no further action will be required.

d. If ^{90}Sr is reported at 0.331 pCi/g or above for postexcavation samples, then excavation of the area and additional surveys and sampling will be conducted as necessary to support the removal action goals until otherwise directed by the DON and RASO. Otherwise, no further action will be required.

e. If any other radioisotope is detected above the RROs stated in the AM, then the Project Radiation Safety Officer (PRSO) will notify the Radiological Site Manager (RSM) and excavation of the area and additional surveys and sampling will continue as necessary to support the removal action goals until otherwise directed by the DON and RASO.

f. If the results of the import material are above the screening criteria listed in the AM, then the material will not be used on-site. Another import fill source will be identified, and SOP HPO-Tt-027 will be followed. Otherwise, the import material will be used as backfill on-site.

6. Specify performance or acceptance criteria

Actions to minimize decision errors will be instituted during the data collection phase of the radiological survey. Qualified radiation survey personnel will perform the surveys and record the data. Automated recording of survey data will be used where possible to minimize errors. Data transcribing is the second phase where errors may arise. To avoid data errors for manual surveys, experienced personnel will record and transcribe data.

The ongoing on-site analyses and evaluation of survey results provide a final check for errors which, if detected, can be corrected.

A knowledgeable individual who is not involved in the direct data collection process (Radiation Safety Officer [RSO], PRSO, or designee) will review the survey data on a daily basis. This will ensure an ongoing independent review for consistency of all survey data collected.

Type I errors occur when the null hypothesis is rejected when it is actually true. The Type I error rate is often referred to as the significance level or size of the test. A Type II error occurs when the null hypothesis is not rejected when it is actually false. The power of a statistical test is defined as the probability of rejecting the null hypotheses when it is false. The survey is designed to limit Type I and II errors to 5 percent. It is important to minimize the chances that area grids exceeding the release limits will be missed (Type I Error) and area grids meeting the release limits will be rejected as too high (Type II Error). The probability of either of these occurring will be set at a maximum of 5 percent; however, in the event double sampling is used, the Type I error will be set at a maximum of 2.5 percent.

SAP Worksheet #11 – Project Quality Objectives/Systematic Planning Process Statements (Continued)

In demonstrating that this objective is met, the null hypothesis is tested that residual contamination exceeds the release criterion; the alternative hypothesis is then tested that residual contamination meets the release criterion.

Field crews will review this SAP prior to collection of samples and sign off on Worksheet #4. An equivalent form to Worksheet #4 may be used.

Sampling and analytical performance or acceptance criteria are specified in Worksheets #12, 15, and 28. Third-party data validation will be performed on samples as described in Worksheets #29 and 36.

7. Develop the plan for obtaining data

Radioactive source readings will be used to check instruments for consistency prior to use in each daily shift. The instrument will only be used after readings are compared and agree within +/- 20 percent of predetermined responses. The on-site RSOR will review the information each day to verify that equipment is operating satisfactorily.

A knowledgeable individual who is not involved in the direct data collection process will review the survey data on a daily basis. This will ensure an ongoing independent review for consistency of all survey data collected.

The Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) guidelines will be used (DoD et al. 2000). A 95 percent confidence level for detecting radioactivity above the release levels will be assumed with Type I and II errors limited to 5 percent, except when double sampling is used. Then the Type I error rate will be set to a maximum of 2.5 percent, as specified in Section 5.5.6.1 of the Work Plan.

The data collecting design alternatives may change slightly if assumptions are reviewed based on conditions in the field being different than the furnished information derived from historical research and current knowledge.

The survey design specified for use in the Work Plan was developed to perform radiological FSSs. Combined with the use of qualified and experienced personnel, this design is considered as both efficient and resource effective.

Operational details for the radiological survey process have been developed for and are included as part of the Work Plan. The theoretical assumptions are based on guidelines contained in MARSSIM. Specific assumptions regarding types of radiation measurements, instrument-detection capabilities, quantities and locations of data to be collected, and investigation levels are contained in the Work Plan.

SAP Worksheet #12 – Measurement Performance Criteria Table for Soil Samples

Measurement Performance Criteria Table – Field QC Samples

QC Sample	Analytical Group	Frequency	Data Quality Indicators	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Equipment blank	VOCs, SVOCs, pesticides, PCBs, TPH-purgeable, TPH-extractable, metals, and gamma-emitting isotopes	1 per non-disposable sampling equipment used for import material samples per day	Accuracy	Analyte < QL	S&A
Field duplicate	Radiological analyses	[a]	Precision	RPD < 30%	S
Laboratory duplicate	Radiological analyses	[b]	Precision	RPD < 30%	A

Notes:

[a] Field duplicates for radiochemical analysis will be collected as directed by the PRSO.

[b] For sampling events that are used to recommend unrestricted release of survey units or sites (namely FSS samples), the on-site laboratory will perform at least one laboratory duplicate per survey unit. Selection of duplicate samples will be as random as possible but ensure that samples with activity less than the quantification or reporting limit are included. It will also ensure that at least one sample per isotope per survey unit will be run for samples above the quantitation limit, if present. The laboratory duplicates for gamma spectroscopy will consist of reanalyzing the original sample in the original container on the same gamma spectroscopy system. In addition, the laboratory may compare radionuclide activities for any other radionuclide that is reported above the quantification or reporting limit during both analyses.

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SAP Worksheet #13 – Secondary Data Criteria and Limitations Table

For this project, secondary data are not applicable.

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SAP Worksheet #14 – Summary of Project Tasks

PROJECT TASKS

- Permitting and notifications
- Preparatory activities and meetings
- Environmental resources surveying
- Clearing vegetation
- Initial geophysical surveying
- Topographic surveying
- Mobilization
- Excavation of soils and removal of piping and systems
- Stormwater, sediment, and erosion control
- Radiological surveys and sampling
- FSSs
- Backfill placement and compaction
- Site restoration
- Free-release survey and decontamination of equipment
- Waste classification, storage, and disposal
- Demobilization

DETAILS ON SAMPLING TASKS

The following sections provide the sampling procedures for this project.

Reference Background Area Sample Procedures

Reference background area samples will be collected as follows:

1. Locations will be chosen based on reference background area radiological survey scans.
2. Sampling personnel will don a new pair of disposable nitrile gloves immediately before collecting soil samples at each location.
3. Grab samples will be collected with a disposable plastic scoop into a 250-milliliter (mL) or 500-mL plastic container that will be filled completely.
4. Each container will be labeled.
5. Samples will be sealed and packaged in accordance with the section below.

SAP Worksheet #14 – Summary of Project Tasks (Continued)

6. Samples will be stored in a cooler or other container without ice.
7. Field documentation including field logbooks and chains of custody (COCs) will be filled out during sample collection.

The samples will then be transferred to the on-site laboratory for analysis.

Soil/Sediment/Swipe Sampling Procedures

Soil/sediment/swipe samples for radiological analyses will be collected as follows:

1. Sampling personnel will don a new pair of disposable nitrile gloves immediately before collecting soil samples at each location.
2. Radiological samples will be collected as specified in the SOP HPO-Tt-009 governing sampling procedures for radiological surveys. This SOP will, at a minimum, establish standards and requirements comparable to those in the SOP presented in Attachment 2.
3. Grab samples for chemical analyses (as appropriate) will be collected with a disposable plastic scoop into sample containers that will be filled completely. An additional sample container may be collected to ensure sufficient sample quantity for analyses. For VOC or TPH-purgeable analysis, three 5-gram En Core® samples will be collected from the sample container or from the soil directly as follows:
    a. Holding the coring body, the plunger rod will be pushed down until the small o-ring rests against the tabs. This will ensure that the plunger will move easily.
    b. The locking lever on the En Core T-handle will be depressed. The coring body, with the plunger end first, will be placed into the open end of the T-handle, aligning the slots of the coring body with the locking pins in the T-handle. The coring body will be twisted clockwise to lock the pins in the slots. The sampler will be checked to ensure that it is locked in place. The sampler will now be ready for use.
    c. By holding the T-handle, the coring body will be pushed into the soil until the coring body is full. When full, the small o-ring will be centered in the T-handle viewing hole. The sampler will then be removed from the soil, and any excess soil will be wiped from the coring body exterior.
    d. The coring body will be capped while it is still on the T-handle. The cap should be pushed over the flat area of the ridge. To lock the cap in place, the cap will be pushed and twisted so that it seals the sampler.
    e. The capped sample will be removed by depressing the locking lever on the T-handle while twisting and pulling the sampler from the T-handle.
    f. The En Core sample will be placed in its aluminum sealed bag.

SAP Worksheet #14 – Summary of Project Tasks (Continued)

g. This procedure will be performed until three En Core samples are collected for each sample. All three En Core samples for VOCs may be placed in one aluminum bag for consolidation purposes.

h. Following completion of the sample label on the outside of the aluminum bag, the aluminum bag will be placed in a resealable bag, a custody seal will be placed over the resealable bag, that bag will be placed in another resealable bag, and then that bag will immediately be placed on ice.

4. Sample numbering, labeling, documentation, and packaging procedures will be followed as described below and in Worksheets #27 and 29.
5. Sampling equipment will be screened and decontaminated between each sample acquisition.

Stockpile Soil Sampling Procedures

Samples for radiological analysis will be collected as specified in the SOP HPO-Tt-009 governing sampling procedures for radiological surveys. This SOP will, at a minimum, establish standards and requirements comparable to those in the SOP presented in Attachment 2. Soil from the stockpile will be sampled for chemical analyses at a rate of one sample for every 500 cubic yards with a minimum of five samples collected for any excavated soil unit less than 2,500 cubic yards using the following procedure:

1. The volume (in cubic yards) of the stockpiles will be calculated using the following formula:

$$V = A \times H/27$$

Where: V = volume in cubic yards
A = area of the base of the stockpile in square feet calculated using one of the following formulas:
Rectangular = length × width
Square = length × width
Triangular = ½ base × height
Circular = 3.14 × radius × radius
Oval = 3.14 × long radius × short radius

H = average height of the stockpile in feet

27 = conversion factor for cubic feet to cubic yards

2. The stockpile will be divided into the number of sections equivalent to the number of samples to be collected.
3. The sample locations within each section will be determined by generating random numbers.
4. A hand auger or similar device will be used to access each x, y, and z coordinate. Due to limitations in accessing deep depths in a large stockpile, z coordinates will be limited to 10 feet.

SAP Worksheet #14 – Summary of Project Tasks (Continued)

5. Sampling personnel will don a new pair of disposable nitrile gloves immediately before collecting soil samples at each location.
6. Grab samples will be collected with a disposable plastic scoop into sample containers that will be filled completely. For VOC or TPH-purgeable analysis, En Core samples will be collected as described above. An additional sample container may be collected to ensure sufficient sample quantity for analyses.
7. A temperature blank will be shipped in each cooler containing field samples for chemical analysis.
8. Sample numbering, labeling, documentation, and packaging procedures will be followed as described in Worksheets #27 and 29.
9. Sampling equipment will be screened and decontaminated between each sample acquisition.

Import Fill Material Sampling Procedures

For verification sampling of any necessary import materials, unless already certified, backfill samples will be collected as follows for chemical analysis. Samples for radiological analysis will be collected as specified in the SOP HPO-Tt-009 governing sampling procedures for radiological surveys. This SOP will, at a minimum, establish standards and requirements comparable to those in the SOP presented in Attachment 2.

If the site from which the backfill is being imported is accessible, then samples will be collected at the site. If the site is not accessible, then material will be sent to the TtEC project site, and samples will be collected as follows:

1. Only soil and fine materials will be sampled. Four samples per borrow area or quarry will be collected.
2. The sample locations will be determined by generating random numbers.
3. A hand auger or similar device will be used to access each x, y, and z coordinate. Due to limitations in accessing deep depths in a large stockpile, z coordinates will be limited to 10 feet.
4. Sampling personnel will don a new pair of disposable nitrile gloves immediately before collecting soil samples at each location.
5. Grab samples will be collected with a disposable plastic scoop into sample containers that will be filled completely. For VOC or TPH-purgeable analysis, En Core samples will be collected as described above. An additional sample container may be collected to ensure sufficient sample quantity for analyses.
6. Sample numbering, labeling, documentation, and packaging procedures will be followed as described in Worksheets #27 and 29.
7. Sampling equipment will be screened and decontaminated between each sample acquisition.

SAP Worksheet #14 – Summary of Project Tasks (Continued)

Waste Characterization Sampling Procedures

Stockpiled soil not suitable for reuse, bins of radiologically impacted soil, and wastewater will be generated during field activities and will require sampling for proper disposal. Where required, samples for radiological analysis will be collected as specified in the SOP HPO-Tt-009 governing sampling procedures for radiological surveys. This SOP will, at a minimum, establish standards and requirements comparable to those in the SOP presented in Attachment 2. Stockpiled soil sampling procedures are described above. Bin and wastewater sampling are described in the sections below.

Bin Sampling Procedures

If the Radiological Waste Broker is performing bin sampling, then sampling of waste bins is not required. Otherwise, bin samples will be collected from each waste type as it is placed into the bin in accordance with SOP HPO-Tt-009, and will be analyzed by the on-site laboratory by gamma spectroscopy.

Wastewater Sampling Procedures

This procedure will be used to collect wastewater samples from approved containers or in situ water samples from an excavation.

1. Sampling personnel will don a new pair of disposable nitrile gloves immediately before collecting wastewater samples.
2. Wastewater samples will be collected using a disposable bailer or similar device. Samples will be transferred from the bailers to pre-preserved, pre-cleaned sample containers.
3. Vials for VOC analysis will be filled as follows:
    a. The water samples will be carefully collected into 40-mL volatile organic analysis (VOA) vials using techniques to minimize aeration.
    b. The vial will be filled up to the lid until a positive meniscus is formed.
    c. The vial will be capped immediately, but slowly.
    d. The sample will be checked for the presence of air bubbles.
    e. If an air bubble is present, the collected sample will be discarded and resampled using a new vial.
    f. The previous steps will be repeated until an air bubble-free sample is collected.
4. Sample numbering, labeling, documentation, and packaging procedures will be followed as described in Worksheets #27 and 29.
5. Sampling equipment will be screened and decontaminated between each sample acquisition.

SAP Worksheet #14 – Summary of Project Tasks (Continued)

Container Content Sampling Procedures

Prior to sampling the contents of the material from each container, a qualitative visual description of the contents of each container will be recorded in the logbook to include the following:

- Any and all exterior markings
- Any unique or unusual container conditions (e.g., reinforced, lined, exotic construction materials)
- Type of opening(s)
- Approximate amount of material contained in the container
- Physical state, color, clarity, viscosity, number, and relative estimated volume of each identified discrete layer or phase
- Readings from real-time health and safety monitors

Swipe samples of material from the containers will be collected in accordance with SOP HPO-Tt-009, Sampling Procedures for Radiological Surveys (Attachment 2), for sampling of radiological materials.

Liquid samples from containers will be extracted through the bunghole if one is on the container. If the container contains mostly solid material rather than liquids, the entire top of the container will be removed to sample the contents. Using an appropriate sampling device or a combination of devices, several representative grab samples with a combined volume of up to approximately 250 mL will be withdrawn from each container and carefully placed into a sampling container. If a container contains more than one phase (e.g., solids and liquids or multi-phase liquids), separate samples are to be taken from each phase. If the volume of any individual phase is so small as to preclude recovery of a sufficient sample (any volume less than 5 mL), a remark to this effect will be recorded in the logbook.

Samples will be numbered, labeled, documented, and packaged according to procedures in Worksheets #27 and 29.

At the same time the sample is collected for the off-site laboratory analysis, an aliquot will be collected in a labeled test tube and transferred to the HazCat area where the HazCat technician(s) will carry out waste-compatibility screening. The parameters described in Worksheet #17 will be tested according to the manufacturer's instructions for the HazCat kit. The results of the HazCat tests will be recorded on a field form and subsequently evaluated to categorize similar types of wastes together for disposal purposes.

SAP Worksheet #14 – Summary of Project Tasks (Continued)

Decontamination Procedures

Prior to decontamination, sampling equipment will be screened using a hand-held alpha/beta survey meter. If radioactive contamination exceeding the release limit is present, the equipment and local area will be secured and the PRSO will be notified.

After radiological screening, nondisposable sampling equipment will be decontaminated to prevent the introduction of extraneous material into samples and to prevent cross-contamination between samples. All sampling equipment will be decontaminated. Decontamination water will be collected in approved Department of Transportation containers.

The following steps will be taken for the general decontamination of nondisposable sampling equipment, as appropriate:

1. **Wash with nonphosphate detergent and water solution** — This step will reduce the amount of gross contamination from the equipment. Use of a container, approximately 75 percent full of solution, is suggested for this step. This detergent solution will be prepared as directed by the manufacturer.
2. **Rinse with potable water** — This step will rinse all the detergent solution away from equipment. Use of a container, approximately 75 percent full of potable water, is suggested for this step. Periodic changing of this water is required.
3. **Rinse with potable water** — Repeat Step 2. Subsequent to this final rinse, place decontaminated equipment on a clean surface area (plastic sheeting) to air dry.
4. **Radiological screening of equipment** — When dry, survey the post-decontaminated equipment using a hand-held alpha/beta survey meter. If radioactive contamination exceeding the release limits is detected, immediately secure the equipment and local area and notify the PRSO.
5. **Sample investigation-derived waste** — Drummed decontamination fluids will be sampled to characterize the waste for disposal. Drums will be stored in a designated storage area pending receipt of the analytical data. Samples will be collected from each wastewater container.

DATA MANAGEMENT TASKS

The following section discusses the data management tasks for this project's field and laboratory data.

Field sampling data, including field logbooks and field forms, will be maintained. The logbooks will be numbered sequentially on the cover by the Project Quality Control Manager (PQCM) and that number will be entered into a logsheet maintained by the PQCM. A copy of all field forms will be maintained in the project file.

A copy of the COCs will be faxed/emailed to the Project Chemist on a daily basis for review and communication with the laboratory. The manila copy of the COC form will be mailed to the

SAP Worksheet #14 – Summary of Project Tasks (Continued)

Project Chemist. The Project Chemist will maintain the manila copy of the COC form until submitted to the Navy Administrative Record along with the hard-copy packages as described in Worksheet #29.

The laboratory will submit data at the turnaround time to TtEC via email. This submittal will include results and basic quality control (QC) results (method blanks, laboratory control sample [LCS], surrogates, and matrix spike/matrix spike duplicates [MS/MSDs]). Following this submittal, the laboratory will be required to submit a Level III- or Level IV-equivalent data package within 20 business days of the sample collection date. For this project, 80 percent of the data will be submitted in an EPA Level III-equivalent data package, and 20 percent will be submitted in an EPA Level IV-equivalent data package as listed on the COC and described in Worksheet #29.

Field data from the COCs (date and time collected, sample identification, etc.) will be entered into the TtEC database by the Project Chemist. Survey data will be recorded and also entered into the database. All sampling locations, except for waste characterization samples, will be surveyed in accordance with Environmental Work Instruction (EWI) EVR.6, Environmental Data Management and Required Electronic Delivery Standards (SWDIV 2005). Horizontal control information will be captured in the State Plane Coordinate System (North American Datum 83) in feet, and vertical control standards will be in mean sea level (North American Vertical Datum 88) in feet. All manual entries into the database will be 100 percent verified by the Project Chemist by checking the manual entry against the hard copy information.

The laboratory will provide an electronic data deliverable (EDD) that will be compatible with TtEC requirements, and the EDD will be uploaded into the TtEC database. The data will be checked for required values and project-specific requirements by the database. Any discrepancies in the EDD will be corrected by TtEC or the laboratory will be notified to make corrections.

All analytical data generated from laboratories, except waste characterization data, will be validated by an independent data validation company. The validation report will include the data validation findings worksheets as described in Worksheet #29, and the validation qualifiers will be entered electronically in the laboratory EDD.

Within 30 calendar days of receipt of the validated data, the validation qualifiers will be uploaded into the TtEC database, and the electronic data will be submitted to the Naval Installation Restoration Information Solution website in Navy Electronic Data Deliverable format in accordance with EWI EVR.6, Environmental Data Management and Required Electronic Delivery Standards (SWDIV 2005).

Hard-copy data will be stored until subsequent submittal to the Navy Administrative Record as described in Worksheet #29. The TtEC database will be electronically backed up on data storage tapes, and the backup will be stored as an archive file.

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples

Matrix: Soil

Analytical Group: Gamma Spectroscopy (on-site laboratory)

Analyte	CAS Number	Project Action Limit (pCi/g)	Project Action Limit Reference	Project MDA (pCi/g)	Laboratory-specific	
					MDAs (pCi/g)	MDLs (pCi/g)
Actinium-228	14331-83-0	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Americium-241	86954-36-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Bismuth-212	14913-49-6	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Bismuth-214	14733-03-0	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Cesium-137	10045-97-3	0.113	RROs	0.07	0.07	Not applicable
Cobalt-60	10198-40-0	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Europium-152	14683-23-9	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Europium-154	15585-10-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Lead-210	14255-04-0	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Lead-212	15092-94-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Lead-214	15067-28-4	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Potassium-40	13966-00-2	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Protactinium-234M	378783-76-7	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Radium-226	13982-63-3	1.0 above background	RROs	1.4	1.4	Not applicable
Thallium-208	14913-50-9	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Thorium-232	7440-29-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Thorium-234	15065-10-8	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Uranium-235	15117-96-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Matrix: Swipe
Analytical Group: Gross Alpha/Gross Beta (on-site laboratory)

Analyte	CAS Number	Project Action Limit (pCi/g)	Project Action Limit Reference	Project MDA (pCi/g)	Laboratory-specific	
					MDAs (pCi/g)	MDLs (pCi/g)
Gross Alpha	12587-46-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Gross Beta	12587-47-2	None established	Not applicable	TBD [a]	TBD [a]	Not applicable

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Matrix: Soil
Analytical Group: Gamma Spectroscopy

Analyte	CAS Number	Project Action Limit (pCi/g)	Project Action Limit Reference	Project MDA (pCi/g)	Laboratory-specific	
					MDAs (pCi/g)	MDLs (pCi/g)
Actinium-228	14331-83-0	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Americium-241	86954-36-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Bismuth-212	14913-49-6	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Bismuth-214	14733-03-0	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Cesium-137	10045-97-3	0.113	RROs	0.07	0.07	Not applicable
Cobalt-60	10198-40-0	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Europium-152	14683-23-9	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Europium-154	15585-10-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Lead-210	14255-04-0	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Lead-212	15092-94-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Lead-214	15067-28-4	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Potassium-40	13966-00-2	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Protactinium-234M	378783-76-7	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Radium-226	13982-63-3	1.0 above background	RROs	0.7	0.7	Not applicable
Thallium-208	14913-50-9	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Thorium-232	7440-29-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Thorium-234	15065-10-8	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Uranium-235	15117-96-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Matrix: Soil
Analytical Group: Strontium-90

Analyte	CAS Number	Project Action Limit (pCi/g)	Project Action Limit Reference	Project MDA (pCi/g)	Laboratory-specific	
					MDAs (pCi/g)	MDLs (pCi/g)
Total Strontium	7440-24-6	0.331	RROs	0.17	0.17	Not applicable
Strontium-90	10098-97-2	0.331	RROs	0.17	0.17	Not applicable

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Matrix: Soil
Analytical Group: Alpha Spectroscopy

Analyte	CAS Number	Project Action Limit (pCi/g)	Project Action Limit Reference	Project MDA (pCi/g)	Laboratory-specific	
					MDAs (pCi/g)	MDLs (pCi/g)
Uranium-233/234	-163	None established	Not applicable	0.1	0.1	Not applicable
Uarnium-235-236	-164	None established	Not applicable	0.1	0.1	Not applicable
Uranium-238	7440-61-1	None established	Not applicable	0.1	0.1	Not applicable
Thorium-228	14274-82-9	None established	Not applicable	0.1	0.1	Not applicable
Thorium-230	14269-63-7	None established	Not applicable	0.1	0.1	Not applicable
Plutonium-238	13981-16-3	None established	Not applicable	0.1	0.1	Not applicable
Plutonium-239/240	10-12-8	None established	Not applicable	0.1	0.1	Not applicable

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Matrix: Soil
Analytical Group: Tritium

Analyte	CAS Number	Project Action Limit (pCi/g)	Project Action Limit Reference	Project MDA (pCi/g)	Laboratory-specific	
					MDAs (pCi/g)	MDLs (pCi/g)
Tritium	10028-17-8	None established	Not applicable	2.00	2.00	Not applicable

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Matrix: Swipe
Analytical Group: Gross Alpha/Gross Beta

Analyte	CAS Number	Project Action Limit (pCi/sample)	Project Action Limit Reference	Project MDA (pCi/sample)	Laboratory-specific	
					MDAs (pCi/sample)	MDLs (pCi/sample)
Gross Alpha	12587-46-1	None established	Not applicable	10	10	Not applicable
Gross Beta	12587-47-2	None established	Not applicable	10	10	Not applicable

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Matrix: Soil
Analytical Group: VOCs

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific	
					QLs (µg/kg)	MDLs (µg/kg)
1,1,1-Trichloroethane	71-55-6	39,000,000	EPA Region 9 Industrial RSL (April 2009)	5	5	0.291
1,1,2,2-Tetrachloroethane	79-34-5	2,900	EPA Region 9 Industrial RSL (April 2009)	5	5	0.272
1,1,2-Trichloroethane	79-00-5	5,500	EPA Region 9 Industrial RSL (April 2009)	5	5	0.573
1,1-Dichloroethane	75-34-3	17,000	EPA Region 9 Industrial RSL (April 2009)	5	5	0.392
1,1-Dichloroethene	75-35-4	1,100,000	EPA Region 9 Industrial RSL (April 2009)	5	5	0.365
1,2-Dichloroethane	107-06-2	2,200	EPA Region 9 Industrial RSL (April 2009)	5	5	0.372
1,2-Dichloropropane	78-87-5	4,700	EPA Region 9 Industrial RSL (April 2009)	5	5	0.317
2-Butanone	78-93-3	190,000,000	EPA Region 9 Industrial RSL (April 2009)	20	20	0.389
2-Hexanone	591-78-6	None established	Not applicable	20	20	0.261
4-methyl-2-pentanone	108-10-1	52,000,000	EPA Region 9 Industrial RSL (April 2009)	20	20	0.326
Acetone	67-64-1	610,000,000	EPA Region 9 Industrial RSL (April 2009)	20	20	6.47
Benzene	71-43-2	5,600	EPA Region 9 Industrial RSL (April 2009)	5	5	0.253
Bromodichloromethane	75-27-4	1,400	EPA Region 9 Industrial RSL (April 2009)	5	5	0.254
Bromoform	75-25-2	220,000	EPA Region 9 Industrial RSL (April 2009)	5	5	0.366
Bromomethane	74-83-9	35,000	EPA Region 9 Industrial RSL (April 2009)	10	10	0.396
Carbon tetrachloride	56-23-5	1,300	EPA Region 9 Industrial RSL (April 2009)	5	5	0.360
Chlorobenzene	108-90-7	1,500,000	EPA Region 9 Industrial RSL (April 2009)	5	5	0.382
Chloroethane	75-00-3	62,000,000	EPA Region 9 Industrial RSL (April 2009)	10	10	0.382
Chloroform	67-66-3	1,500	EPA Region 9 Industrial RSL (April 2009)	5	5	0.092

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific	
					QLs (µg/kg)	MDLs (µg/kg)
Chloromethane	74-87-3	510,000	EPA Region 9 Industrial RSL (April 2009)	10	10	0.553
cis-1,2-Dichloroethene	156-59-2	10,000,000	EPA Region 9 Industrial RSL (April 2009)	5	5	0.159
cis-1,3-Dichloropropene	10061-01-5	8,400	EPA Region 9 Industrial RSL (April 2009)	5	5	0.339
Dibromochloromethane	124-48-1	3,400	EPA Region 9 Industrial RSL (April 2009)	5	5	0.329
Ethylbenzene	100-41-4	29,000	EPA Region 9 Industrial RSL (April 2009)	5	5	0.299
Methyl tert-butyl ether	1634-04-4	190,000	EPA Region 9 Industrial RSL (April 2009)	5	5	0.401
Methylene chloride	75-09-2	54,000	EPA Region 9 Industrial RSL (April 2009)	5	5	0.801
Styrene	100-42-5	38,000,000	EPA Region 9 Industrial RSL (April 2009)	5	5	0.347
Tetrachloroethene	127-18-4	2,700	EPA Region 9 Industrial RSL (April 2009)	5	5	0.280
Toluene	108-88-3	46,000,000	EPA Region 9 Industrial RSL (April 2009)	5	5	0.303
trans-1,2-Dichloroethene	156-60-5	500,000	EPA Region 9 Industrial RSL (April 2009)	5	5	0.178
trans-1,3-Dichloropropene	10061-02-6	84,000,000	EPA Region 9 Industrial RSL (April 2009)	5	5	0.349
Trichloroethene	79-01-6	14,000	EPA Region 9 Industrial RSL (April 2009)	5	5	0.290
Vinyl chloride	75-01-4	1,700	EPA Region 9 Industrial RSL (April 2009)	5	5	0.428
Xylenes (Total)	1330-20-7	2,600,000	EPA Region 9 Industrial RSL (April 2009)	10	10	0.854

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Matrix: Soil
Analytical Group: SVOCs

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific	
					QLs (µg/kg)	MDLs (µg/kg)
1,2,4-Trichlorobenzene	120-82-1	400,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
1,2-Dichlorobenzene	95-50-1	10,000,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
1,3-Dichlorobenzene	541-73-1	None established	Not applicable	330	330	33.3
1,4-Dichlorobenzene	106-46-7	13,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
2,4,5-Trichlorophenol	95-95-4	62,000,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
2,4,6-Trichlorophenol	88-06-2	160,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
2,4-Dichlorophenol	120-83-2	1,800,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
2,4-Dimethylphenol	105-67-9	12,000,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
2,4-Dinitrophenol	51-28-5	1,200,000	EPA Region 9 Industrial RSL (April 2009)	1,600	1,600	330
2,4-Dinitrotoluene	121-14-2	5,500	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
2,6-Dinitrotoluene	606-20-2	620,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
2-Chloronaphthalene	91-58-7	82,000,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
2-Chlorophenol	95-57-8	5,100,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
2-Methylphenol (o-cresol)	95-48-7	31,000,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
2-Nitroaniline	88-74-4	1,800,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
2-Nitrophenol	88-75-5	None established	Not applicable	330	330	33.3
3,3′-Dichlorobenzidine	91-94-1	3,800	EPA Region 9 Industrial RSL (April 2009)	1,600	1,600	33.3
3-Nitroaniline	99-09-2	None established	Not applicable	330	330	33.3
¾-Methylphenol (m/p-cresol)	-3495	3,100,000	EPA Region 9 Industrial RSL (April 2009)	660	660	66.6

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific	
					QLs (µg/kg)	MDLs (µg/kg)
4,6-Dinitro-2-methylphenol	534-52-1	62,000	EPA Region 9 Industrial RSL (April 2009)	1,600	1,600	330
4-Bromophenyl-phenylether	101-55-3	None established	Not applicable	330	330	33.3
4-Chloro-3-methylphenol	59-50-7	None established	Not applicable	330	330	33.3
4-Chloroaniline	106-47-8	8,600	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
4-Chlorophenyl-phenylether	7005-72-3	None established	Not applicable	330	330	33.3
4-Nitroaniline	100-01-6	86,000	EPA Region 9 Industrial RSL (April 2009)	1,600	1,600	330
4-Nitrophenol	100-02-7	None established	Not applicable	1,600	1,600	330
bis(2-Chloroethoxy)methane	111-91-1	1,800,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
bis(2-Chloroethyl)ether	111-44-4	900	EPA Region 9 Industrial RSL (April 2009)	330	330	33.4
bis(2-Chloroisopropyl)ether	108-60-1	17,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
bis(2-Ethylhexyl)phthalate	117-81-7	120,000	EPA Region 9 Industrial RSL (April 2009)	330	330	43.3
Butylbenzyl phthalate	85-68-7	910,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Dibenzofuran	132-64-9	Not established	Not applicable	330	330	33.3
Diethyl phthalate	84-66-2	490,000,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Dimethyl phthalate	131-11-3	Not established	Not applicable	330	330	33.3
Di-n-butyl phthalate	84-74-2	62,000,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Di-n-octyl phthalate	117-84-0	Not established	Not applicable	330	330	33.3
Hexachlorobenzene	118-74-1	1,100	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Hexachlorobutadiene	87-68-3	22,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Hexachlorocyclopentadiene	77-47-4	3,700,000	EPA Region 9 Industrial RSL (April 2009)	1,600	1,600	330
Hexachloroethane	67-72-1	120,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Nitrobenzene	98-95-3	22,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific	
					QLs (µg/kg)	MDLs (µg/kg)
n-Nitrosodiphenylamine	86-30-6	350,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
n-Nitroso-di-n-propylamine	621-64-7	250	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Pentachlorophenol	87-86-5	9,000	EPA Region 9 Industrial RSL (April 2009)	660	660	330
Phenol	108-95-2	180,000,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Pyridine	110-86-1	1,000,000	EPA Region 9 Industrial RSL (April 2009)	660	660	66.6
Acenaphthene	83-32-9	33,000,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Acenaphthylene	208-96-8	Not established	Not applicable	330	330	33.3
Anthracene	120-12-7	170,000,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Benzo(a)anthracene	56-55-3	2,100	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Benzo(a)pyrene	50-32-8	210	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Benzo(b)fluoranthene	205-99-2	2,100	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Benzo(g,h,i)perylene	191-24-2	Not established	Not applicable	330	330	33.3
Benzo(k)fluoranthene	207-08-9	21,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Chrysene	218-01-9	210,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Dibenzo(a,h)anthracene	53-70-3	210	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Fluoranthene	206-44-0	22,000,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Fluorene	86-73-7	22,000,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Indeno(1,2,3-cd)pyrene	193-39-5	2,100	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Naphthalene	91-20-3	20,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3
Phenanthrene	85-01-8	Not established	Not applicable	330	330	33.3
Pyrene	129-00-0	17,000,000	EPA Region 9 Industrial RSL (April 2009)	330	330	33.3

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Matrix: Soil
Analytical Group: Pesticides

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific	
					QLs (µg/kg)	MDLs (µg/kg)
4,4′-DDD	72-54-8	7,200	EPA Region 9 Industrial RSL (April 2009)	1.7	1.7	0.082
4,4′-DDE	72-55-9	5,100	EPA Region 9 Industrial RSL (April 2009)	1.7	1.7	0.390
4,4′-DDT	50-29-3	7,000	EPA Region 9 Industrial RSL (April 2009)	1.7	1.7	0.628
alpha-BHC	319-84-6	270	EPA Region 9 Industrial RSL (April 2009)	1.7	1.7	0.133
Aldrin	309-00-2	100	EPA Region 9 Industrial RSL (April 2009)	1.7	1.7	0.306
beta-BHC	319-85-7	960	EPA Region 9 Industrial RSL (April 2009)	1.7	1.7	0.300
delta-BHC	319-86-8	Not established	Not applicable	1.7	1.7	0.242
Chlordane (technical)	12789-03-6	6,500	EPA Region 9 Industrial RSL (April 2009)	17	17	3.729
Dieldrin	60-57-1	110	EPA Region 9 Industrial RSL (April 2009)	1.7	1.7	0.215
Endosulfan sulfate	1031-07-8	3,700,000	EPA Region 9 Industrial RSL (April 2009)	1.7	1.7	0.249
Endosulfan I	959-98-8	3,700,000	EPA Region 9 Industrial RSL (April 2009)	1.7	1.7	0.570
Endosulfan II	33213-65-9	3,700,000	EPA Region 9 Industrial RSL (April 2009)	1.7	1.7	0.235
Endrin	72-20-8	180,000	EPA Region 9 Industrial RSL (April 2009)	1.7	1.7	0.136
Endrin aldehyde	7421-93-4	Not established	Not applicable	1.7	1.7	0.389
Endrin ketone	53494-70-5	Not established	Not applicable	1.7	1.7	0.297
gamma-BHC (Lindane)	58-89-9	2,100	EPA Region 9 Industrial RSL (April 2009)	1.7	1.7	0.168
Heptachlor	76-44-8	380	EPA Region 9 Industrial RSL (April 2009)	1.7	1.7	0.095
Heptachlor epoxide	1024-57-3	190	EPA Region 9 Industrial RSL (April 2009)	1.7	1.7	0.429

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific	
					QLs (µg/kg)	MDLs (µg/kg)
Methoxychlor	72-43-5	3,100,000	EPA Region 9 Industrial RSL (April 2009)	3.3	3.3	0.719
Toxaphene	8001-35-2	1,600	EPA Region 9 Industrial RSL (April 2009)	67	67	15.16

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Matrix: Soil
Analytical Group: PCBs

Analyte	CAS Number	Project Action Limit (µg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/kg)	Laboratory-specific	
					QLs (µg/kg)	MDLs (µg/kg)
Aroclor 1016	12674-11-2	21,000	EPA Region 9 Industrial RSL (April 2009)	33	33	5.39
Aroclor 1221	11104-28-2	620	EPA Region 9 Industrial RSL (April 2009)	33	33	5.39
Aroclor 1232	11141-16-5	620	EPA Region 9 Industrial RSL (April 2009)	33	33	5.39
Aroclor 1242	53469-21-9	740	EPA Region 9 Industrial RSL (April 2009)	33	33	5.39
Aroclor 1248	12672-29-6	740	EPA Region 9 Industrial RSL (April 2009)	33	33	5.39
Aroclor 1254	11097-69-1	740	EPA Region 9 Industrial RSL (April 2009)	33	33	6.13
Aroclor 1260	11096-82-5	740	EPA Region 9 Industrial RSL (April 2009)	33	33	6.13

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Matrix: Soil
Analytical Group: TPH-purgeable (gasoline) and TPH-extractable (diesel and motor oil)

Analyte	CAS Number	Project Action Limit (mg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific	
					QLs (mg/kg)	MDLs (mg/kg)
TPH-gasoline (C_6-C_{10})	8006-61-9	None established	Not applicable	0.1	0.1	0.01
TPH-diesel (C_{10}-C_{24})	-3527 [b]	None established	Not applicable	10	10	0.333
TPH-motor oil (C_{24}-C_{36})	-3528 [b]	None established	Not applicable	10	10	0.637

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Matrix: Soil [a]
Analytical Group: Metals

Analyte	CAS Number	Project Action Limit (mg/kg)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/kg)	Laboratory-specific	
					QLs (mg/kg)	MDLs (mg/kg)
Antimony	7440-36-0	410	EPA Region 9 Industrial RSL (April 2009)	0.5	0.5	0.164
Arsenic	7440-38-2	1.6	EPA Region 9 Industrial RSL (April 2009)	1	1	0.203
Barium	7440-39-3	190,000	EPA Region 9 Industrial RSL (April 2009)	2	2	0.057
Beryllium	7440-41-7	2,000	EPA Region 9 Industrial RSL (April 2009)	0.1	0.1	0.011
Cadmium	7440-43-9	800	EPA Region 9 Industrial RSL (April 2009)	0.05	0.05	0.011
Chromium	7440-47-3	1,500,000	EPA Region 9 Industrial RSL (April 2009)	1	1	0.302
Cobalt	7440-48-4	300	EPA Region 9 Industrial RSL (April 2009)	0.2	0.2	0.043
Copper	7440-50-8	41,000	EPA Region 9 Industrial RSL (April 2009)	1	1	0.054
Lead	7439-92-1	800	EPA Region 9 Industrial RSL (April 2009)	0.30	0.30	0.026
Mercury	7439-97-6	24	EPA Region 9 Industrial RSL (April 2009)	0.033	0.033	0.006
Molybdenum	7439-98-7	5,100	EPA Region 9 Industrial RSL (April 2009)	0.5	0.5	0.077
Nickel	7440-02-0	20,000	EPA Region 9 Industrial RSL (April 2009)	0.5	0.5	0.082
Selenium	7782-49-2	5,100	EPA Region 9 Industrial RSL (April 2009)	0.5	0.5	0.045
Silver	7440-22-4	5,100	EPA Region 9 Industrial RSL (April 2009)	0.2	0.2	0.008
Thallium	7440-28-0	66	EPA Region 9 Industrial RSL (April 2009)	0.2	0.2	0.058
Vanadium	7440-62-2	5,200	EPA Region 9 Industrial RSL (April 2009)	1	1	0.735
Zinc	7440-66-6	310,000	EPA Region 9 Industrial RSL (April 2009)	5	5	1.33

SAP Worksheet #15.1 – Reference Limits and Evaluation Table for Soil/Swipe Samples (Continued)

Matrix: Soil
Analytical Group: Asbestos

Analyte	CAS Number	Project Action Limit (percent)	Project Action Limit Reference	Project Quantitation Limit Goal (percent)	Laboratory-specific	
					QLs (percent)	MDLs (percent)
Asbestos	132207-33-1	0.25	Bay Area Air Quality Management District	0.25	0.25	Not applicable

Notes:

[a] Project quantitation limits and minimum detectable activities for radiological analyses are calculated per samples per analysis. Therefore, these values are listed as to be determined until a project action limit is applicable since these are determined based on background, sample size, and count time.

[b] CAS number listed is from the NEDD valid value list since a CAS number is not available for this analyte.

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples

Matrix: Water
Analytical Group: Gamma Spectroscopy (on-site laboratory)

Analyte	CAS Number	Project Action Limit (pCi/L)	Project Action Limit Reference	Project MDA (pCi/L)	Laboratory-specific	
					MDAs (pCi/L)	MDLs (pCi/L)
Actinium-228	14331-83-0	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Americium-241	86954-36-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Bismuth-212	14913-49-6	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Bismuth-214	14733-03-0	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Cesium-137	10045-97-3	119	Wastewater Discharge Permit	60	60	Not applicable
Cobalt-60	10198-40-0	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Europium-152	14683-23-9	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Europium-154	15585-10-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Lead-210	14255-04-0	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Lead-212	15092-94-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Lead-214	15067-28-4	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Potassium-40	13966-00-2	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Protactinium-234M	378783-76-7	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Radium-226	13982-63-3	5	Wastewater Discharge Permit	2.5	2.5	Not applicable
Thallium-208	14913-50-9	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Thorium-232	7440-29-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Thorium-234	15065-10-8	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Uranium-235	15117-96-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Matrix: Water
Analytical Group: Gamma Spectroscopy

Analyte	CAS Number	Project Action Limit (pCi/L)	Project Action Limit Reference	Project MDA (pCi/L)	Laboratory-specific	
					MDAs (pCi/L)	MDLs (pCi/L)
Actinium-228	14331-83-0	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Americium-241	86954-36-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Bismuth-212	14913-49-6	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Bismuth-214	14733-03-0	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Cesium-137	10045-97-3	119	Wastewater Discharge Permit	60	60	Not applicable
Cobalt-60	10198-40-0	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Europium-152	14683-23-9	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Europium-154	15585-10-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Lead-210	14255-04-0	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Lead-212	15092-94-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Lead-214	15067-28-4	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Potassium-40	13966-00-2	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Protactinium-234M	378783-76-7	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Thallium-208	14913-50-9	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Thorium-232	7440-29-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Thorium-234	15065-10-8	None established	Not applicable	TBD [a]	TBD [a]	Not applicable
Uranium-235	15117-96-1	None established	Not applicable	TBD [a]	TBD [a]	Not applicable

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Matrix: Water
Analytical Group: Radium-226

Analyte	CAS Number	Project Action Limit (pCi/L)	Project Action Limit Reference	Project MDA (pCi/L)	Laboratory-specific	
					MDAs (pCi/L)	MDLs (pCi/L)
Radium-226	13982-63-3	5	Wastewater Discharge Permit	2.5	2.5	Not applicable

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Matrix: Water
Analytical Group: Strontium-90

Analyte	CAS Number	Project Action Limit (pCi/L)	Project Action Limit Reference	Project MDA (pCi/L)	Laboratory-specific	
					MDAs (pCi/L)	MDLs (pCi/L)
Total Strontium	7440-24-6	8	Wastewater Discharge Permit	4	4	Not applicable
Strontium-90	10098-97-2	8	Wastewater Discharge Permit	4	4	Not applicable

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Matrix: Water
Analytical Group: Alpha Spectroscopy

Analyte	CAS Number	Project Action Limit (pCi/L)	Project Action Limit Reference	Project MDA (pCi/L)	Laboratory-specific	
					MDAs (pCi/L)	MDLs (pCi/L)
Uranium-233/234	-163	None established	Not applicable	0.10	0.10	Not applicable
Uarnium-235/236	-164	None established	Not applicable	0.10	0.10	Not applicable
Uranium-238	7440-61-1	None established	Not applicable	0.10	0.10	Not applicable
Thorium-228	14274-82-9	None established	Not applicable	0.10	0.10	Not applicable
Thorium-230	14269-63-7	None established	Not applicable	0.10	0.10	Not applicable
Plutonium-238	13981-16-3	None established	Not applicable	0.10	0.10	Not applicable
Plutonium-239/240	10-12-8	None established	Not applicable	0.10	0.10	Not applicable

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Matrix: Water
Analytical Group: Tritium

Analyte	CAS Number	Project Action Limit (pCi/L)	Project Action Limit Reference	Project MDA (pCi/L)	Laboratory-specific	
					MDAs (pCi/L)	MDLs (pCi/L)
Tritium	10028-17-8	None established	Not applicable	500	500	Not applicable

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Matrix: Water
Analytical Group: VOCs

Analyte	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/L)	Laboratory-specific	
					QLs (µg/L)	MDLs (µg/L)
1,1,1-Trichloroethane	71-55-6	Not established	Not applicable	5	5	0.291
1,1,2,2-Tetrachloroethane	79-34-5	Not established	Not applicable	5	5	0.272
1,1,2-Trichloroethane	79-00-5	Not established	Not applicable	5	5	0.573
1,1-Dichloroethane	75-34-3	Not established	Not applicable	5	5	0.392
1,1-Dichloroethene	75-35-4	700	Wastewater Discharge Permit	5	5	0.365
1,2-Dichloroethane	107-06-2	500	Wastewater Discharge Permit	5	5	0.372
1,2-Dichloropropane	78-87-5	Not established	Not applicable	5	5	0.317
2-Butanone (MEK)	78-93-3	200,000	Wastewater Discharge Permit	20	20	0.389
2-Hexanone	591-78-6	Not established	Not applicable	20	20	0.261
4-Methyl-2-pentanone	108-10-1	Not established	Not applicable	20	20	0.326
Acetone	67-64-1	Not established	Not applicable	20	20	6.47
Benzene	71-43-2	500	Wastewater Discharge Permit	5	5	0.253
Bromodichloromethane	75-27-4	Not established	Not applicable	5	5	0.254
Bromoform	75-25-2	Not established	Not applicable	5	5	0.366
Bromomethane	74-83-9	Not established	Not applicable	10	10	0.396
Carbon tetrachloride	56-23-5	500	Wastewater Discharge Permit	5	5	0.360
Chlorobenzene	108-90-7	100,000	Wastewater Discharge Permit	5	5	0.382
Chloroethane	75-00-3	Not established	Not applicable	10	10	0.382
Chloroform	67-66-3	6,000	Wastewater Discharge Permit	5	5	0.092

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Analyte	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/L)	Laboratory-specific	
					QLs (µg/L)	MDLs (µg/L)
Chloromethane	74-87-3	Not established	Not applicable	10	10	0.553
cis-1,2-Dichloroethene	156-59-2	Not established	Not applicable	5	5	0.159
cis-1,3-Dichloropropene	10061-01-5	Not established	Not applicable	5	5	0.339
Dibromochloromethane	124-48-1	Not established	Not applicable	5	5	0.329
Ethylbenzene	100-41-4	Not established	Not applicable	5	5	0.299
Methyl tert-butyl ether	1634-04-4	Not established	Not applicable	5	5	0.401
Methylene chloride	75-09-2	Not established	Not applicable	5	5	0.801
Styrene	100-42-5	Not established	Not applicable	5	5	0.347
Tetrachloroethene	127-18-4	700	Wastewater Discharge Permit	5	5	0.280
Toluene	108-88-3	Not established	Not applicable	5	5	0.303
trans-1,2-Dichloroethene	156-60-5	Not established	Not applicable	5	5	0.178
trans-1,3-Dichloropropene	10061-02-6	Not established	Not applicable	5	5	0.349
Trichloroethene	79-01-6	500	Wastewater Discharge Permit	5	5	0.290
Vinyl chloride	75-01-4	200	Wastewater Discharge Permit	5	5	0.428
Xylenes (Total)	1330-20-7	Not established	Not applicable	10	10	0.854

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Matrix: Water
Analytical Group: SVOCs

Analyte	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/L)	Laboratory-specific	
					QLs (µg/L)	MDLs (µg/L)
1,2,4-Trichlorobenzene	120-82-1	Not established	Not applicable	10	10	1.00
1,2-Dichlorobenzene	95-50-1	Not established	Not applicable	10	10	1.00
1,3-Dichlorobenzene	541-73-1	Not established	Not applicable	10	10	1.00
1,4-Dichlorobenzene	106-46-7	7,500	Wastewater Discharge Permit	10	10	1.00
2,4,5-Trichlorophenol	95-95-4	400,000	Wastewater Discharge Permit	10	10	1.00
2,4,6-Trichlorophenol	88-06-2	2,000	Wastewater Discharge Permit	10	10	1.00
2,4-Dichlorophenol	120-83-2	Not established	Not applicable	10	10	1.00
2,4-Dimethylphenol	105-67-9	Not established	Not applicable	10	10	1.00
2,4-Dinitrophenol	51-28-5	Not established	Not applicable	50	50	2.00
2,4-Dinitrotoluene	121-14-2	130	Wastewater Discharge Permit	10	10	1.00
2,6-Dinitrotoluene	606-20-2	Not established	Not applicable	10	10	2.16
2-Chloronaphthalene	91-58-7	Not established	Not applicable	10	10	1.00
2-Chlorophenol	95-57-8	Not established	Not applicable	10	10	1.00
2-Methylphenol (o-cresol)	95-48-7	200,000	Wastewater Discharge Permit	10	10	2.00
2-Nitroaniline	88-74-4	Not established	Not applicable	10	10	1.00
2-Nitrophenol	88-75-5	Not established	Not applicable	10	10	1.00
3,3'-Dichlorobenzidine	91-94-1	Not established	Not applicable	50	50	1.00
3-Nitroaniline	99-09-2	Not established	Not applicable	10	10	1.00
3/4-Methylphenol (m/p-cresol)	-3495	200,000	Wastewater Discharge Permit	10	10	2.00

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Analyte	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/L)	Laboratory-specific	
					QLs (µg/L)	MDLs (µg/L)
4,6-Dinitro-2-methylphenol	534-52-1	Not established	Not applicable	10	10	1.00
4-Bromophenyl-phenylether	101-55-3	Not established	Not applicable	10	10	1.00
4-Chloro-3-methylphenol	59-50-7	Not established	Not applicable	10	10	1.00
4-Chloroaniline	106-47-8	Not established	Not applicable	10	10	1.00
4-Chlorophenyl-phenylether	7005-72-3	Not established	Not applicable	10	10	1.00
4-Nitroaniline	100-01-6	Not established	Not applicable	10	10	1.00
4-Nitrophenol	100-02-7	Not established	Not applicable	10	10	2.00
bis(2-Chloroethoxy)methane	111-91-1	Not established	Not applicable	10	10	1.00
bis(2-Chloroethyl)ether	111-44-4	Not established	Not applicable	10	10	1.00
bis(2-Chloroisopropyl)ether	108-60-1	Not established	Not applicable	10	10	1.00
bis(2-Ethylhexyl)phthalate	117-81-7	Not established	Not applicable	10	10	1.00
Butylbenzyl phthalate	85-68-7	Not established	Not applicable	10	10	1.00
Dibenzofuran	132-64-9	Not established	Not applicable	10	10	1.00
Diethyl phthalate	84-66-2	Not established	Not applicable	10	10	1.00
Dimethyl phthalate	131-11-3	Not established	Not applicable	10	10	1.00
Di-n-butyl phthalate	84-74-2	Not established	Not applicable	10	10	1.00
Di-n-octyl phthalate	117-84-0	Not established	Not applicable	10	10	1.00
Hexachlorobenzene	118-74-1	130	Wastewater Discharge Permit	10	10	1.00
Hexachlorobutadiene	87-68-3	500	Wastewater Discharge Permit	10	10	1.00
Hexachlorocyclopentadiene	77-47-4	Not established	Not applicable	10	10	1.00
Hexachloroethane	67-72-1	3,000	Wastewater Discharge Permit	10	10	1.00

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Analyte	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/L)	Laboratory-specific	
					QLs (µg/L)	MDLs (µg/L)
Nitrobenzene	98-95-3	2,000	Wastewater Discharge Permit	10	10	1.00
n-Nitrosodiphenylamine	86-30-6	Not established	Not applicable	10	10	1.00
n-Nitroso-di-n-propylamine	621-64-7	Not established	Not applicable	10	10	1.00
Pentachlorophenol	87-86-5	100,000	Wastewater Discharge Permit	10	10	1.27
Phenol	108-95-2	Not established	Not applicable	10	10	2.00
Pyridine	110-86-2	5,000	Wastewater Discharge Permit	20	20	2.00

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Matrix: Water
Analytical Group: SVOCs by SIM

Analyte	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/L)	Laboratory-specific	
					QLs (µg/L)	MDLs (µg/L)
Acenaphthene	83-32-9	Not established	Not applicable	0.2	0.2	0.02
Acenaphthylene	208-96-8	Not established	Not applicable	0.2	0.2	0.02
Anthracene	120-12-7	Not established	Not applicable	0.2	0.2	0.021
Benzo(a)anthracene	56-55-3	Not established	Not applicable	0.2	0.2	0.025
Benzo(a)pyrene	50-32-8	Not established	Not applicable	0.2	0.2	0.025
Benzo(b)fluoranthene	205-99-2	Not established	Not applicable	0.2	0.2	0.031
Benzo(g,h,i)perylene	191-24-2	Not established	Not applicable	0.2	0.2	0.021
Benzo(k)fluoranthene	207-08-9	Not established	Not applicable	0.2	0.2	0.034
Chrysene	218-01-9	Not established	Not applicable	0.2	0.2	0.026
Dibenzo(a,h)anthracene	53-70-3	Not established	Not applicable	0.2	0.2	0.028
Fluoranthene	206-44-0	Not established	Not applicable	0.2	0.2	0.031
Fluorene	86-73-7	Not established	Not applicable	0.2	0.2	0.020
Indeno(1,2,3-cd)pyrene	193-39-5	Not established	Not applicable	0.2	0.2	0.029
Naphthalene	91-20-3	Not established	Not applicable	0.2	0.2	0.020
Phenanthrene	85-01-8	Not established	Not applicable	0.2	0.2	0.037
Pyrene	129-00-0	Not established	Not applicable	0.2	0.2	0.023

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Matrix: Water
Analytical Group: Pesticides

Analyte	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/L)	Laboratory-specific	
					QLs (µg/L)	MDLs (µg/L)
4,4′-DDD	72-54-8	Not established	Not applicable	0.05	0.05	0.01
4,4′-DDE	72-55-9	Not established	Not applicable	0.05	0.05	0.02
4,4′-DDT	50-29-3	Not established	Not applicable	0.05	0.05	0.01
alpha-BHC	319-84-6	Not established	Not applicable	0.05	0.05	0.01
Aldrin	309-00-2	Not established	Not applicable	0.05	0.05	0.01
beta-BHC	319-85-7	Not established	Not applicable	0.05	0.05	0.01
delta-BHC	319-86-8	Not established	Not applicable	0.05	0.05	0.01
Chlordane (technical)	57-74-9	30	Wastewater Discharge Permit	0.5	0.5	0.04
Dieldrin	60-57-1	Not established	Not applicable	0.05	0.05	0.01
Endosulfan sulfate	1031-07-8	Not established	Not applicable	0.05	0.05	0.01
Endosulfan I	959-98-8	Not established	Not applicable	0.05	0.05	0.02
Endosulfan II	33213-65-9	Not established	Not applicable	0.05	0.05	0.01
Endrin	72-20-8	20	Wastewater Discharge Permit	0.05	0.05	0.01
Endrin aldehyde	7421-93-4	Not established	Not applicable	0.05	0.05	0.01
Endrin ketone	53494-70-5	Not established	Not applicable	0.05	0.05	0.02
gamma-BHC (Lindane)	58-89-9	400	Wastewater Discharge Permit	0.05	0.05	0.003
Heptachlor	76-44-8	8	Wastewater Discharge Permit	0.05	0.05	0.003
Heptachlor epoxide	1024-57-3	8	Wastewater Discharge Permit	0.05	0.05	0.01

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Analyte	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/L)	Laboratory-specific QLs (µg/L)	Laboratory-specific MDLs (µg/L)
Methoxychlor	72-43-5	10,000	Wastewater Discharge Permit	0.1	0.1	0.01
Toxaphene	8001-35-2	500	Wastewater Discharge Permit	2.0	2.0	0.66

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Matrix: Water
Analytical Group: PCBs

Analyte	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/L)	Laboratory-specific	
					QLs (µg/L)	MDLs (µg/L)
Aroclor 1016	12674-11-2	Not established	Not applicable	1	1	0.0841
Aroclor 1221	11104-28-2	Not established	Not applicable	1	1	0.0841
Aroclor 1232	11141-16-5	Not established	Not applicable	1	1	0.0841
Aroclor 1242	53469-21-9	Not established	Not applicable	1	1	0.0841
Aroclor 1248	12672-29-6	Not established	Not applicable	1	1	0.0841
Aroclor 1254	11097-69-1	Not established	Not applicable	1	1	0.0845
Aroclor 1260	11096-82-5	Not established	Not applicable	1	1	0.0845

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Matrix: Water
Analytical Group: TPH-purgeable (gasoline) and TPH-extractable (diesel and motor oil)

Analyte	CAS Number	Project Action Limit (mg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/L)	Laboratory-specific	
					QLs (mg/L)	MDLs (mg/L)
TPH-gasoline (C_6-C_{10})	8006-61-9	Not established	Not applicable	0.1	0.1	0.01
TPH-diesel (C_{10}-C_{24})	-3527 [b]	Not established	Not applicable	0.5	0.5	0.017
TPH-motor oil (C_{24}-C_{36})	-3528 [b]	Not established	Not applicable	0.5	0.5	0.023

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Matrix: Water
Analytical Group: Metals

Analyte	CAS Number	Project Action Limit [a] (µg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/L)	Laboratory-specific	
					QLs (µg/L)	MDLs (µg/L)
Antimony	7440-36-0	Not established	Not applicable	5	5	1.12
Arsenic	7440-38-2	4,000	Wastewater Discharge Permit	10	10	0.946
Barium	7440-39-3	Not established	Not applicable	2	2	0.196
Beryllium	7440-41-7	Not established	Not applicable	0.5	0.5	0.114
Cadmium	7440-43-9	500	Wastewater Discharge Permit	0.5	0.5	0.055
Chromium	7440-47-3	5,000	Wastewater Discharge Permit	10	10	3.26
Cobalt	7440-48-4	Not established	Not applicable	2	2	0.217
Copper	7440-50-8	4,000	Wastewater Discharge Permit	1	1	0.097
Lead	7439-92-1	1,500	Wastewater Discharge Permit	3	3	0.173
Mercury	7439-97-6	50	Wastewater Discharge Permit	0.2	0.2	0.05
Molybdenum	7439-98-7	Not established	Not applicable	5	5	0.216
Nickel	7440-02-0	2,000	Wastewater Discharge Permit	5	5	0.231
Selenium	7782-49-2	Not established	Not applicable	5	5	0.308
Silver	7440-22-4	600	Wastewater Discharge Permit	2	2	0.040
Thallium	7440-28-0	Not established	Not applicable	2	2	0.55
Vanadium	7440-62-2	Not established	Not applicable	10	10	2.37
Zinc	7440-66-6	7,000	Wastewater Discharge Permit	5	5	3.74

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Matrix: Water
Analytical Group: Herbicides

Analyte	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/L)	Laboratory-specific	
					QLs (µg/L)	MDLs (µg/L)
2,4-D	94-75-7	10,000	Wastewater Discharge Permit	4	4	1.98
2,4-DB	94-82-6	Not established	Not applicable	4	4	2.11
2,4,5-T	93-76-5	Not established	Not applicable	1	1	0.179
2,4,5-TP (Silvex)	93-72-1	1,000	Wastewater Discharge Permit	1	1	0.298
Dalapon	75-99-0	Not established	Not applicable	4	4	2.91
Dicamba	1918-00-9	Not established	Not applicable	2	2	0.399
Dichloroprop	120-36-5	Not established	Not applicable	4	4	2.01
Dinoseb	88-85-7	Not established	Not applicable	1	1	0.269
MCPA	94-74-6	Not established	Not applicable	400	400	191
MCPP	93-65-2	Not established	Not applicable	400	400	138

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Matrix: Water
Analytical Group: Oil and Grease

Analyte	CAS Number	Project Action Limit (mg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/L)	Laboratory-specific	
					QLs (mg/L)	MDLs (mg/L)
Oil and Grease	-46 [b]	100	Wastewater Discharge Permit	5	5	2.12

Matrix: Water
Analytical Group: TRPH

Analyte	CAS Number	Project Action Limit (mg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/L)	Laboratory-specific	
					QLs (mg/L)	MDLs (mg/L)
TRPH	-3530 [b]	300	Wastewater Discharge Permit	5	5	2.03

Matrix: Water
Analytical Group: TSS

Analyte	CAS Number	Project Action Limit (mg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/L)	Laboratory-specific	
					QLs (mg/L)	MDLs (mg/L)
TSS	-20 [b]	None established	Wastewater Discharge Permit	4	4	Not applicable

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Matrix: Water
Analytical Group: pH

Analyte	CAS Number	Project Action Limit (pH units)	Project Action Limit Reference	Project Quantitation Limit Goal (pH units)	Laboratory-specific	
					QLs (pH units)	MDLs (pH units)
pH	-9 [b]	6.0-9.5	Wastewater Discharge Permit	0.1	0.1	Not applicable

Matrix: Water
Analytical Group: Ignitability

Analyte	CAS Number	Project Action Limit (°C)	Project Action Limit Reference	Project Quantitation Limit Goal (°C)	Laboratory-specific	
					QLs (°C)	MDLs (°C)
Ignitability	-3120 [b]	≥ 60	Wastewater Discharge Permit	Not applicable	Not applicable	Not applicable

Matrix: Water
Analytical Group: COD

Analyte	CAS Number	Project Action Limit (mg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/L)	Laboratory-specific	
					QLs (mg/L)	MDLs (mg/L)
COD	-13 [b]	None established	Wastewater Discharge Permit	20	20	6.47

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Matrix: Water
Analytical Group: Total/Dissolved Sulfide

Analyte	CAS Number	Project Action Limit (mg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (mg/L)	Laboratory-specific	
					QLs (mg/L)	MDLs (mg/L)
Total sulfide	18496-25-8	0.5	Wastewater Discharge Permit	1	1	0.453
Dissolved sulfide	18496-25-8	0.5	Wastewater Discharge Permit	1	1	0.453

Matrix: Water
Analytical Group: Cyanide

Analyte	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/L)	Laboratory-specific	
					QLs (µg/L)	MDLs (µg/L)
Cyanide	57-12-5	1,000	Wastewater Discharge Permit	10	10	3.52

Matrix: Water
Analytical Group: Phenols

Analyte	CAS Number	Project Action Limit (µg/L)	Project Action Limit Reference	Project Quantitation Limit Goal (µg/L)	Laboratory-specific	
					QLs (µg/L)	MDLs (µg/L)
Phenols	108-95-2	23,000	Wastewater Discharge Permit	50	50	14.05

SAP Worksheet #15.2 – Reference Limits and Evaluation Table for Water Samples (Continued)

Notes:

[a] Project quantitation limits and minimum detectable activities for radiological analyses are calculated per samples per analysis. Therefore, these values are listed as to be determined until a project action limit is applicable since these are determined based on background, sample size, and count time.

[b] CAS number listed is from the NEDD valid value list since a CAS number is not available for this analyte.

SAP Worksheet #16 – Project Schedule / Timeline Table

Since this SAP is being produced as an update in the UFP/QAPP format to the original base-wide SAP, and the projects are ongoing from previous task orders, an exact schedule is not included herein.

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SAP Worksheet #17 – Sampling Design and Rationale

BACKGROUND (REFERENCE) SAMPLING

Prior to the start of pipeline excavation activities, an average background level will be determined by performing a minimum of 18 measurements at systematic or random locations within a designated background area as described in Section 4.11.1 of the Work Plan. Additional background samples may be collected as directed by the RSM. The soil samples will be collected in the background area at systematic locations and analyzed by the on-site laboratory by gamma spectroscopy to establish average background values for ^{226}Ra and ^{137}Cs, which will be used in conjunction with the RROs listed in Table A-1.

The background values for ^{226}Ra and ^{137}Cs will be determined at the on-site laboratory, by counting for a period typically necessary to meet the applicable maximum minimum detectable activity (MDA) listed in Worksheet #15.1. If the results of the average background determination indicate ^{226}Ra activity less than half the release criterion (without regard to MDA), with few or no negative results, then the background will be considered acceptable.

Background values will be calculated using the reported activity, regardless of whether the value is below the MDA or less than zero.

Measurement uncertainty values will be considered acceptable if, in the opinion of the on-site laboratory manager, a longer duration count would not improve the counting statistics markedly, and:

1. The two-sigma total uncertainty for ^{226}Ra is less than 10 pCi/g for activity indicated below the MDA.

2. The two-sigma uncertainty for ^{137}Cs is less than 10 pCi/g for activity indicated below the MDA.

Data collected in reference areas will be statistically evaluated using a graphical format, such as a frequency distribution chart, and approved for use by the RASO. The purpose of the evaluation is to ensure that the data collected in the reference area are consistent with a normal distribution and that the variability of the background is not too high.

Ten percent of these samples will also be analyzed for ^{90}Sr and alpha spectroscopy, as necessary, by the on-site laboratory. Ten percent of the reference area samples shall be sent to an off-site laboratory for quality assurance (QA) purposes and counted in the cumulative number of samples processed by the on-site laboratory. This requirement shall apply specifically to the background (reference) area and FSS samples, in addition to the cumulative total described above.

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

PIPE REMOVAL SAMPLING

The general approach to removing the storm drain and sanitary sewer lines will be to first remove the overlying pavement, then excavate the soils, and subsequently remove the pipelines. Radiological screening and sampling will be performed ex situ on excavated soil, pipe, and debris.

To remove the storm and sanitary sewer lines, surface pavement (where present) will be removed from the limits of the excavation. The surface pavement material will be stockpiled and evaluated for potential reuse as granular surface material, subject to the approval of the DON, or disposed of as waste.

The soil overlying each storm and sanitary sewer line will be excavated and transported to a designated RSY for subsequent survey and sampling activities. The depth of the excavation will extend to a minimum of 1 foot below the pipeline. Excavated soil removed from within an identified IRP site will be managed separately from other IRP sites. Excavated soil removed from non-IRP site areas will be managed so that, once free released, it can be returned to the general area from which it was excavated.

Following removal of the excavated soil, the sewer pipelines will be removed. To the extent practicable, the pipes and manholes will be removed and stockpiled separately. If the piping cannot be extracted separately (as may be the case for terracotta pipe), the piping will be stockpiled, sampled, and surveyed as excavated soil (ES).

Where practicable, pipe segments shall be removed intact. The pipe will be placed in designated stockpile/laydown areas within the radiologically controlled area from which it was removed to allow for radiological characterization and sampling as required. Excavated piping will be considered potentially radiologically contaminated until survey and sampling data prove otherwise, and it shall be controlled as potentially radioactively contaminated material and handled accordingly. Every effort will be made to contain silts and debris that may be inside the pipe. If sediment is present within removed piping, a minimum of one sample will be collected for every 10 linear feet for radiological analysis. These sediment samples will be collected from the interior surfaces of extracted piping and components and analyzed by gamma spectroscopy by the on-site laboratory. Open sewer or storm drain lines left in place during the removal process will be plugged to prevent water from entering or exiting pipes and to prevent the release of any contamination that may be present in the lines. In no case will sediments from removal or installation work be allowed to enter the bay.

In-place and excavated piping, piping components, and large debris will be screened for alpha and beta/gamma emitters. Swipe samples will be collected from the interior and exterior surfaces to identify the presence of removable surface contamination for the purposes of health and safety monitoring and equipment and debris release. Swipe samples will be analyzed at the on-site laboratory using a gas-flow proportional alpha and beta/gamma radiation counter. A minimum of one exterior and one interior swipe sample will be collected for each 10 linear

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

feet of excavated piping. Additional swipe samples may be collected based on the result of the field surveys, and are typically collected in the event that a specific criteria or release limit has been exceeded and additional information is necessary to determine the impact in order to properly release the debris.

In instances where surveys cannot be performed, such as broken piping, the pipe will be managed as ES. Radiologically contaminated material identified during pipe surveys will be stored at the originating site pending disposal. Additional samples will be analyzed for ^{90}Sr and alpha spectroscopy if ^{137}Cs activity above the release criteria is identified during on-site laboratory gamma spectroscopy analysis.

A grab soil sample will be collected from the bottom of the excavated trench section where there is evidence of a breach in the storm drain/sanitary sewer structure. A breach will be defined as 1) gap/crack/break in the pipe segments; 2) abrupt end to a pipe (open ended); 3) missing section of pipe/conduit; and 4) other visible signs of pipe/conduit failure/leakage. The sample will be analyzed for the radioactivity and chemicals of concern from upgradient sources.

If it is practical and required to remove piping from a radiologically impacted site, an initial surface radiological survey will be performed to identify surface and near-surface (less than 30 centimeters [12 inches] below ground surface) radioactive material for subsequent removal and proper on-site storage pending disposal through the DON's LLRW Disposal Program prior to excavation.

Excavated debris and piping components not radiologically contaminated will be stockpiled in a temporary laydown area. Subsequently, these wastes will be transported off-site for disposal at a CERCLA Off-site Rule-approved landfill. Trucks transporting these nonradiological wastes will pass through the on-site portal monitor prior to exiting HPS.

Excavated soil, piping, and debris will be placed on stockpile/laydown pads for storage, sampling, and/or radiological screening. Water collected from the screening pads will be characterized for chemical and radiological constituents.

Throughout the excavation process, soil and piping shall be visually inspected for chemical staining or odors. Material from an IRP site that emits odors or is stained shall be segregated for further characterization sampling and analysis by another DON contractor in accordance with the disposal facilities requirements. (Characterization and disposal are not included in the scope of work for TtEC for this type of material.) If the material is identified outside the bounds of an IRP site, then the DON will be notified to determine any further action.

Drums, bottles, jars, and small containers with unknown contents may be located during excavation activities. When these items are located, the procedure included in Attachment 1 of the Work Plan will be used to determine safety measures and procedures needed to inspect, handle, remove, and dispose of them.

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

All soil and sediment samples will be analyzed by gamma spectroscopy by the on-site radiological laboratory. A minimum of 10 percent of the samples analyzed for gamma spectroscopy also will be analyzed for ^{90}Sr by the on-site laboratory. Additional samples will be analyzed for ^{90}Sr, isotopic plutonium, and isotopic uranium, if the on-site laboratory results indicate concentrations of ^{137}Cs at or above its RRO. When on-site laboratory results indicate concentrations of ^{90}Sr at the RRO or greater, additional analysis for isotopic plutonium and isotopic uranium will be performed at the on-site laboratory. Isotopic plutonium, isotopic uranium, and ^{90}Sr analysis can also be performed by the off-site laboratory. A minimum of 10 percent of all radiological analyses performed by the on-site laboratory shall be submitted to an off-site laboratory for QA purposes.

Trench segment piping identified as having radioactive materials present above the RRO will require further trench sampling to characterize the extent of contamination, as directed by the RSO. No scoping survey will need to be performed on these Trench Units (TUs).

Samples will be collected in accordance with the procedures described above.

EXCAVATED SOIL SAMPLING

Excavated soil will be transported to a screening pad for subsequent dewatering (if necessary) and radiological survey activities. Excavated soil placed on the screening pads will be spread out in lifts not to exceed 6 inches in height and up to 1,000 square meters (m^2) in surface area. As necessary, the material will be allowed to dewater prior to performing radiological surveys. The radiological surface survey will consist of a high-density survey process with the use of sodium iodide (NaI) detectors. The high-density survey process will result in a 100 percent scan survey, as detailed in Section 4.0 of the Work Plan. Radioactive material identified during screening activities will be collected, segregated, and stored in appropriate containers for subsequent packaging and disposal under the direction of the DON LLRW Disposal Program as directed by the PRSO.

Collected field data will be logged and survey points plotted on survey unit grid maps to document survey results. These data will be used to directly tie the locations of any elevated radiation measurements to the corresponding grid coordinates, which will be established during the development of the systematic sampling plan. Data analysis will be performed as the data are received, and questionable areas will be flagged in the field for resurvey/verification. Locations where surface radiation levels appear to be greater than 3 sigma of the mean background level will be noted on a subcontractor-provided grid map. Areas confirmed as having radiation levels greater than the established 3 sigma of the mean background area level will be evaluated further for the presence of radioactive material and may include additional biased sampling points. If radioactive material is confirmed, the area will be physically marked and the associated radioactive material removed.

A minimum of 18 systematic solid samples will be collected for each survey unit of excavated soil (up to 1,000 m^2) and placed on the screening pad for a Scoping Survey and FSS. Any

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

contamination found in ES will be characterized and remediated as directed by the RSO. Remedial action support surveys will be performed until post-remediation sample results are less than the RROs. Scoping survey sample data may be used as the FSS if all sample results are less than the RROs.

Scoping survey and FSS samples will be systematically collected based on a random start point and sample spacing utilizing Equation 4-2 from the Base-wide Storm Drain and Sanitary Sewer Removal Project Work Plan, Revision 1 (Base-wide Work Plan, Rev. 1) (TtEC 2007) or using the most current version of Visual Sample Plan (VSP) software with a triangular grid pattern. Additional samples will be collected at locations where the investigation level is exceeded, or as directed by the PRSO or RSM. The samples will be analyzed at the on-site radiological laboratory by gamma spectroscopy. Excavated soil determined to have residual radioactive contamination below the RROs after a single phase of systematic sampling may be used as backfill, pending additional chemical analytical results. Radiologically contaminated material identified during surveys or sample analysis will be placed in storage containers pending disposal.

The DON has applied a conservative remediation decision criteria (any one sample result exceeding the action level or RRO will require remediation), and this conservative approach effectively overrides the large uncertainty in single sample results. Measurement uncertainty values will be considered acceptable if, in the opinion of the on-site laboratory manager, a longer duration count would not improve the counting statistics markedly, and:

1. The two-sigma total uncertainty for ^{226}Ra is less than 10 pCi/g for activity indicated below the MDA.
2. The two-sigma uncertainty for ^{137}Cs is less than 10 pCi/g for activity indicated below the MDA.

Since any indicated activity above the release criteria will be remediated prior to an FSS, using these limits for uncertainty measurement effectively overrides a larger uncertainty in a single sample result.

A minimum of 10 percent of the FSS samples analyzed by the on-site radiological laboratory will be randomly selected and sent to an off-site laboratory for QA purposes. The PRSO or designee may select additional samples for off-site analysis for QA purposes, if appropriate. Data from the on-site and off-site gamma spectroscopy analysis will be compared, and the acceptance criterion of relative percent difference (RPD) for each on-site/off-site laboratory pair is established at 30 percent in instances where the same method was used for analysis, and when both activities are reported above the quantification or reporting limit (with no qualifiers or flags). When off-site laboratory results are less than the on-site laboratory results, an RPD greater than 30 will not be investigated since the on-site laboratory results are used for decision making and are biased high by design. Any off-site laboratory result greater than the on-site laboratory result with an RPD greater than 30 will require an investigation to resolve the

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

discrepancy. In cases where the RPD is greater than 30 and the off-site laboratory activity is greater than the on-site laboratory activity, the RASO and the DON will be notified and corrective actions will be identified and implemented. At the direction of the RASO and/or DON, corrective actions may include, but not be limited to, reanalysis of the sample by the appropriate laboratory, additional field sampling, counting for an additional time period, or analysis by alternative vendors.

TRENCH SAMPLING

Following completion of excavation activities, scoping surveys of the trenches will be completed. If the scoping survey sample results are less than the RROs, then the scoping survey data will be used as an FSS, and backfilling or limited storm drain replacement will be acceptable with the concurrence of the RASO. Scoping surveys and FSSs for the excavated sections will include scans and systematic sampling. A minimum of 18 samples will be collected after establishing a grid consisting of cells not to exceed 1,000 m^2 over the excavated trench surfaces (sidewalls and bottom). Systematic sample collection locations will be generated using the most current version of VSP.

Any area from a trench with results indicating that radioactive materials are present above the RROs will be characterized and remediated. Remedial action support surveys will be considered completed when post-remediation sample results do not indicate activity above the RROs. An FSS will be performed on each TU after the remedial action support survey has concluded. TUs will be considered acceptable for backfill or limited storm drain replacement when no contamination is found above the RROs during a single phase of systematic sampling, either from a scoping survey or FSS.

The DON has applied a conservative remediation decision criteria (any one sample result exceeding the action level or RRO will require remediation) and the conservative approach effectively overrides the large uncertainty in single sample results. Measurement uncertainty values will be considered acceptable if, in the opinion of the laboratory manager, a longer duration count would not improve the counting statistics markedly, and:

1. The two-sigma total uncertainty for ^{226}Ra is less than 10 pCi/g for activity indicated below the MDA.
2. The two-sigma uncertainty for ^{137}Cs is less than 10 pCi/g for activity indicated below the MDA.

Since any indicated activity above the release criteria will be remediated prior to an FSS, using these limits for uncertainty measurement effectively overrides a larger uncertainty in a single sample result.

The postexcavation trench soil samples will be analyzed by the on-site laboratory by gamma spectroscopy with 10 percent of the FSS samples analyzed for ^{90}Sr. If on-site laboratory results

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

indicate concentrations of ^{137}Cs at or above its RRO, the sample will be analyzed by the on-site or off-site laboratory for ^{90}Sr and alpha spectroscopy analysis (typically for isotopic plutonium and uranium). If laboratory results indicate concentrations of ^{90}Sr at the RRO or greater, additional analysis for isotopic plutonium and uranium will be performed.

A minimum of 10 percent of the FSS soil samples analyzed by the on-site laboratory will be randomly selected and sent to an off-site laboratory for gamma spectroscopy analysis for QA purposes. The PRSO or designee may select additional samples for off-site analysis for QA purposes, if appropriate. Data from the on-site and off-site gamma spectroscopy analysis will be compared, and the acceptance criteria of RPD for each on-site/off-site laboratory pair are established at 30 in instances where the same method was used for analysis, and when both activities are reported above the quantification or reporting limit (with no qualifiers or flags). When off-site laboratory results are less than the on-site laboratory results, an RPD greater than 30 will not be investigated since the on-site laboratory results are used for decision making and are biased high by design. Any off-site laboratory result greater than the on-site laboratory result with an RPD greater than 30 will require an investigation to resolve the discrepancy. In cases where the RPD greater than 30 and the off-site laboratory activity is greater than the on-site laboratory activity, the RASO and the DON will be notified and corrective actions will be identified and implemented. At the direction of the RASO and/or DON, corrective actions may include, but not be limited to, reanalysis of the sample by the appropriate laboratory, additional field sampling, counting for an additional time period, or analysis by alternative vendors.

IMPORT FILL MATERIAL SAMPLING

Excavated soil cleared of radioactivity (and, where excavated from IRP sites, for location-specific chemicals of concern) will be used as backfill at HPS. However, additional soil may be imported for use as fill. Imported material to be used as backfill material at HPS will be evaluated in accordance with the HPS Backfill Review and Acceptance Procedure, HPO-Tt-0270 (DCN: FWSD-RAC-06-0764), the SOPs provided in Attachment 2.

Four randomly located material samples will be collected from each imported material source prior to use and analyzed by the off-site laboratory for VOCs, SVOCs with polynuclear aromatic hydrocarbons (PAHs) by selective ion monitoring (SIM) mode, pesticides, PCBs, TPH-purgeable, TPH-extractable, metals, and gamma-emitting isotopes. Frequency and analysis of import material were selected following the guidelines established by DTSC in the Information Advisory on Clean Imported Fill Material (DTSC 2001). If the facility cannot provide a certificate stating that material does not contain asbestos, the four samples collected will also be analyzed for asbestos. Only soil or fine materials will be sampled. Gravel and rock will not be sampled but will be required to be cleaned, washed, free of fines, and from an approved/acceptable source (certified not to contain asbestos). If gravel or rock sources cannot provide a certificate, then four samples of the gravel or rock will be tested for asbestos.

SAP Worksheet #17 – Sampling Design and Rationale (Continued)

WASTE CHARACTERIZATION SAMPLING

Wastes that will be generated during excavation activities include LLRW and/or low-level mixed waste of soil, sediment, debris (including piping and system components), and wastewater. Non-radiological generated waste may include soil and sediment, debris (including piping and system components), and wastewater.

Soil/sediment and debris identified as radioactively contaminated will be stored in B-25 boxes or bins and will be sampled to characterize the soil/sediment for disposal. If the Radiological Waste Broker is performing sampling, then TtEC will not be required to perform waste bin sampling. Otherwise, at least one sample will be collected and analyzed by gamma spectroscopy by the on-site laboratory for each waste type placed in the bin, and the results will be provided to the RASO or other parties as directed.

During removal actions, monitoring wells may be located within the excavation footprint. If possible, wells will be preserved, but if preservation is not possible or deemed unnecessary by the DON, wells may be abandoned. Waste materials results from overdrilling each well or piezometer, such as soil cuttings and well-casing remnants, will be screened and sampled for radioactive material.

If the results of analyses for the chemicals of concern associated with excavated soil from IRP sites (see Table A-3 for a list of chemicals of concern associated with each IRP site) indicate that the soil is not suitable for reuse on-site, then additional chemical analyses may be performed to adequately characterize the material for off-site disposal. Additional analyses may include VOCs, SVOCs, pesticides, PCBs, TPH-purgeable, TPH-extractable, and Title 22 metals, asbestos, Soluble Threshold Limit Concentration, and Toxicity Characteristic Leaching Procedure. The actual characterization analyses requested will depend on the types of analyses previously performed on the material and the analyses required to profile the material for disposal. Samples will be collected at a frequency of one sample per 500 cubic yards of soil with a minimum of five samples collected from any excavated soil unit with a total volume less than 2,500 cubic yards.

If groundwater is present in the excavation, it may be pumped directly to an approved storage container. To the extent practicable, waters from known groundwater plume locations will be collected and stored separately from waters in non-IR site locations. If light non-aqueous phase liquid, dense non-aqueous phase liquid, or high concentrations of VOCs in the breathing zone are encountered, in situ water may be sampled.

Water from the dewatering pads and decontamination activities will be collected and stored in approved storage containers. One water sample per approved container may be collected and analyzed by the off-site laboratory for VOCs, SVOCs, pesticides, PCBs, herbicides, Title 22 metals, TPH-purgeable, TPH-extractable, total oil and grease, total recoverable petroleum hydrocarbons, pH, total suspended solids, ignitability, total cyanide, phenols, chemical oxygen demand, dissolved sulfide, and radionuclides as required per the disposal facility. (If smaller

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SAP Worksheet #17 – Sampling Design and Rationale (Continued)

containers such as drums are used to contain the wastewater, then the frequency of samples collected for waste characterization will be determined by the TtEC Regulatory Compliance Specialist.)

Drums, bottles, jars, and small containers with unknown contents unearthed during the excavation activities will be first screened by field instruments for radioactivity, and then a swipe sample will be collected from the inside of each container and analyzed on-site using a gas-flow proportional alpha and beta/gamma radiation counter. A sample of the container content may be collected and sent to an off-site laboratory for gamma spectroscopy, ^{90}Sr, or alpha spectroscopy, based upon review of the swipe sample results. Once the containers are sampled for radioactivity, the containers will undergo “HazCating” or “waste compatibility screening,” which is defined as a series of rapid, qualitative chemical and physical tests conducted to determine potential hazards, handling precautions, storage criteria, and the disposal classification of the material in question.

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SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table

Sampling Location / ID Number	Matrix	Depth (feet)	Analytical Group	Number of Samples	Sampling SOP Reference
Reference background area (WW-PX-RA-UU)	Soil	Surface	Alpha, beta, and gamma-emitting isotopes	TBD [a]	Worksheet #14
Inside piping [a] (WW-PXPI-QQQQ-UU)	Sediment	N/A	Alpha, beta, and gamma-emitting isotopes	TBD [a]	Worksheet #14
Interior and exterior of piping [a] (WW-PXS-AABBCC-SS-UU)	Swipe	N/A	Alpha/beta	TBD [a]	Worksheet #14
Postexcavation samples from trench walls and floor [a] (WW-PXT-YYY-UUU)	Soil	TBD	Alpha, beta, and gamma-emitting isotopes	TBD [a]	Worksheet #14
Import fill material [b] (WW-BACKFILL-UUU)	Soil	Random	VOCs, SVOCs, pesticides, PCBs, TPH-purgeable, TPH-extractable, Title 22 metals, asbestos, and gamma-emitting isotopes	TBD [a]	Worksheet #14
Excavated soil chemical samples (not radioactive) [c] (WW-PX-IRYY-ZZZZ)	Soil	Random	Per each IRP associated list of chemicals of concern	TBD [a]	Worksheet #14
Soil stockpile waste (initial radiological screening) [d]	Soil	Random	Gamma-emitting isotopes	TBD [a]	Worksheet #14
Soil stockpile waste (not radioactive) [d]	Soil	Random	VOCs, SVOCs, pesticides, PCBs, TPH-purgeable, TPH-extractable, Title 22 metals	TBD [a]	Worksheet #14
Soil bin waste (radioactive) [d] (WW-PXB-YYYYYYY-UU)	Soil	Random	Radionuclides	TBD [a]	Worksheet #14
Wastewater [d]	Water	N/A	VOCs, SVOCs, pesticides, PCBs, herbicides, Title 22 metals, TPH-purgeable, TPH-extractable, total oil and grease, total recoverable petroleum hydrocarbons, pH, total suspended solids, ignitability, total cyanide, phenols, chemical oxygen demand, dissolved sulfide, and radionuclides	TBD [a]	Worksheet #14

SAP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

Notes:

[a] The number of locations cannot be determined until excavation of piping and thus the length and size of piping and trench are determined. However, each location will be numbered sequentially and with nomenclature that identifies it as piping or postexcavation trench wall/floor samples.

[b] The number of import fill samples will be determined in the field based on the amount of import material sources samples. However, import material samples will be identified with the source name and a sequential number.

[c] One soil sample from an IRP site will be collected per 500 cubic yards of soil, with a minimum of 5 samples collected from any excavated soil unit with a total volume less than 2,500 cubic yards.

[d] The number of waste samples will be determined in the field based on the amount of soil excavated and wastewater generated. However, each waste will be identified with a sequential number and nomenclature identifying the waste from a stockpile, drum, bin, or other container.

SAP Worksheet #19 – Analytical SOP Requirements Table

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers	Sample Volume	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Soil	Gamma Spectroscopy (on-site laboratory)	C1402-98 Standard Guide for High-Resolution Gamma-ray Spectrometry SOP RCHL-A-05	250-mL or 500-mL plastic container	250 mL	None	N/A
Swipe	Alpha/beta-emitting radionuclides (on-site laboratory)	Gross alpha/beta by gas-flow proportional counter or ZnS(Ag) detector; Low-energy beta by liquid scintillation counter SOP RCHL-A-02A	250-mL or 500-mL plastic container	250 mL	None	N/A
Soil	Gamma Isotopes	EPA 901.1 MOD SOP ST-RD-0102	One 250 mL, poly/glass	250 to 400 g	None	180 days [c]
Soil	Strontium-90	EPA 905 MOD or DOE SR-03-RC MOD SOP ST-RC-0050 or ST-RD-0403	One 250 mL, poly/glass	5 g	None	180 days [c]
Soil	Isotopic Uranium, Plutonium, Thorium	DOE A-01-R MOD SOP ST-RD-0210	One 250 mL, poly/glass	5 g	None	180 days [c]
Soil	Tritium	EPA 906.0 MOD SOP ST-RD-0302	One 250 mL poly/glass	100 g	None	180 days [c]
Swipe	Alpha/beta-emitting radionuclides	EPA 9310 or equivalent SOP ST-RD-0403	Envelope with paper swipe	Swipe	None	N/A
Soil	VOCs	EPA 5035A/8260C SOP ST-MS-0002	Three 5-gram En Core samplers [a]	15 grams	4±2°C	48 hours/14 days [b]
Soil	TPH-purgeable	EPA 5035A/8015B SOP ST-GC-00149	Three 5-gram En Core samplers [a]	15 grams	4±2°C	48 hours/14 days [b]
Soil	SVOCs	EPA 3550B/8270D SOP ST-OP-0002 R12/ST-MS-0001	One 8-ounce glass jar	8 ounces	4±2°C	14 days/40 days [b]

SAP Worksheet #19 – Analytical SOP Requirements Table (Continued)

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers	Sample Volume	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Soil	Pesticides	EPA 3550B/8081B SOP ST-OP-0002 /ST-GC-0016	One 8-ounce glass jar	8 ounces	4±2°C	14 days/40 days [b]
Soil	PCBs	EPA 3550B/8082A SOP ST-OP-0002/ST-GC-0015	One 8-ounce glass jar	8 ounces	4±2°C	14 days/40 days [b]
Soil	TPH-extractable	EPA 3550B/8015B SOP ST-OP-0002/ST-GC-0005	One 8-ounce glass jar	8 ounces	4±2°C	14 days/40 days [b]
Soil	Metals	EPA 3050B/6020A SOP ST-IP-0002/ST-MT- 0001	One 8-ounce glass jar	8 ounces	4±2°C	180 days [c]
Soil	Mercury	EPA 7471B SOP ST-MT-0007	One 8-ounce glass jar	8 ounces	4±2°C	28 days [c]
Soil	Asbestos	CARB 435 SOP III-A	One 8-ounce glass jar	8 ounces	4±2°C	N/A

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SAP Worksheet #19 – Analytical SOP Requirements Table (Continued)

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers	Sample Volume	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water	Gamma Spectroscopy (on-site laboratory)	C1402-98 Standard Guide for High-Resolution Gamma-ray Spectrometry SOP RCHL-A-05	250-mL or 500-mL plastic container	250 mL	None	N/A
Water	Strontium-90	EPA 905 MOD or DOE SR-03-RC MOD SOP ST-RC-0050 or ST-RD-0403	One 1 L, poly/glass	1 L	HNO_3 pH<2	180 days [c]
Water	Radium-226	EPA 903.0 MOD SOP ST-RD-0403	One 1 L poly/glass	1 L	HNO_3 pH<2	180 days [c]
Water	Gamma Isotopes	EPA 901.1 MOD SOP ST-RD-0102	One 1 L poly/glass	1 L	HNO_3 pH<2	180 days [c]
Water	Isotopic Uranium, Plutonium, Thorium	DOE A-01-R MOD SOP ST-RD-0210	One 1 L, poly/glass	1 L	HNO_3 pH<2	180 days [c]
Water	Tritium	EPA 906.0 MOD SOP ST-RD-0302	One 250 mL, Amber glass	120 mL	None	180 days [c]
Water	VOCs	EPA 5030B/8260C SOP ST-MS-0002	Three 40-mL VOA vials	120 mL	pH ≤ 2 w/HCl, 4±2°C	14 days [c]
Water	TPH-purgeable	EPA 5030B/8015B SOP ST-GC-0014	Three 40-mL VOA vials	120 mL	pH ≤ 2 w/HCl, 4±2°C	14 days [c]
Water	SVOCs (including SIM for PAHs)	EPA 3510C/8270D SOP ST-OP-0002/ST-MS-0001	Two 1-L amber bottles	2 L	4±2°C	7 days/40 days [b]
Water	Pesticides	EPA 3510C/8081B SOP ST-OP-0002/ST-GC-0016	Two 1-L amber bottles	2 L	4±2°C	7 days/40 days [b]
Water	PCBs	EPA 3510C/8082A SOP ST-OP-0002/ST-GC-0015	Two 1-L amber bottles	2 L	4±2°C	7 days/40 days [b]
Water	TPH-extractable	EPA 3510C/8015B SOP ST-OP-0002/ST-GC-0005	Two 1-L amber bottles	2 L	4±2°C	7 days/40 days [b]

SAP Worksheet #19 – Analytical SOP Requirements Table (Continued)

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference	Containers	Sample Volume	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)
Water	Title 22 Metals	EPA 3010A/6020A SOP ST-IP-0013/ST-MT-0001	One 500-mL poly bottle	500 mL	pH ≤ 2 w/HNO3	180 days [c]
Water	Mercury	EPA 7470A SOP ST-MT-0005	One 500-mL poly bottle	500 mL	pH ≤ 2 w/HNO3	28 days [c]
Water	Herbicides	EPA 3510C/8151A SOP ST-OP-0007/ST-GC-0017	Two 1-L amber bottles	2 L	4±2°C	7 days/40 days [b]
Water	Oil and Grease	EPA 1664 SOP ST-WC-0039	Two 1-L amber bottles	2 L	pH ≤ 2 w/ HCl, 4±2°C	28 days [c]
Water	TRPH (silica gel)	EPA 1664 SOP ST-WC-0039	Two 1-L amber bottles	2 L	pH ≤ 2 w/ HCl, 4±2°C	28 days [c]
Water	TSS	EPA 160.1 SOP ST-WC-0036	One 500-mL poly bottle	500 mL	4±2°C	7 days [c]
Water	pH	EPA 150.1 SOP ST-WC-0011	One 250-mL poly bottle	250 mL	4±2°C	Upon receipt at laboratory
Water	Ignitability	EPA 1010 SOP ST-WC-0026	One 250-mL poly bottle	250 mL	4±2°C	180 days [c]
Water	COD	EPA 410.4 SOP ST-WC-0004	One 250-mL poly bottle	250 mL	pH ≤ 2 w/ H2SO4, 4±2°C	28 days [c]
Water	Total/Dissolved sulfide	EPA 376.1 SOP ST-WC-0012	One 500-mL poly bottle	500 mL	pH ≤ 2 w/NaOH and ZnAC, 4±2°C	7 days [c]
Water	Cyanide	EPA 335.4 SOP ST-WC-0002	One 500-mL poly bottle	500 mL	pH ≤ 2 w/NaOH, 4±2°C	14 days [c]
Water	Phenols	EPA 420.1 SOP ST-WC-0017	Two 1-L amber bottles	2 L	pH ≤ 2 w/H2SO4, 4±2°C	28 days [c]

SAP Worksheet #19 – Analytical SOP Requirements Table (Continued)

Notes:

[a] If En Core samplers cannot be used due to saturated soil, then only the 8-ounce jar will be used, and VOC analysis will be conducted from the jar sample.

[b] The time listed is the maximum holding time for the preparation/analysis.

[c] The time listed is the maximum holding time for the analysis. Preparation time is included in the analytical method holding time.

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SAP Worksheet #20 – Field Quality Control Sample Summary Table

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates (FD) or Laboratory Duplicates (LD)	No. of MS/MSDs	No. of Field Blanks	No. of Equipment Blanks	No. of VOA Trip Blanks	No. of PT Samples	Total No. of Samples to Lab
Pipe Removal Samples									
Soil/sediment/s wipe	Gamma-emitting isotopes	TBD[a]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[a]
Soil/sediment/s wipe	Alpha-emitting isotopes	TBD[a]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[a]
Soil/sediment/s wipe	Beta-emitting isotopes	TBD[a]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[a]
Trench and Excavation Soil Samples									
Soil	Gamma-emitting isotopes	TBD[a]	See Worksheet #12	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[a]
Soil	Beta-emitting isotopes	TBD[a]	See Worksheet #12	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[a]
Soil	Alpha-emitting isotopes	TBD[a]	See Worksheet #12	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[a]
Import Fill Soil Samples									
Soil	Gamma-emitting isotopes	TBD[b]	1 (FSS LD only) 1 per SDG (LD only)	1 per 20 samples	1 per lot	1 per day per equipment	Not applicable	Not applicable	TBD[b]
Soil	VOCs	TBD[b]	1 FD per 10 samples	1 per 20 samples	1 per lot	1 per day per equipment	Not applicable	Not applicable	TBD[b]
Soil	SVOCs	TBD[b]	1 FD per 10 samples	1 per 20 samples	1 per lot	1 per day per equipment	Not applicable	Not applicable	TBD[b]
Soil	Pesticides	TBD[b]	1 FD per 10 samples	1 per 20 samples	1 per lot	1 per day per equipment	Not applicable	Not applicable	TBD[b]
Soil	PCBs	TBD[b]	1 FD per 10 samples	1 per 20 samples	1 per lot	1 per day per equipment	Not applicable	Not applicable	TBD[b]

SAP Worksheet #20 – Field Quality Control Sample Summary Table (Continued)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates (FD) or Laboratory Duplicates (LD)	No. of MS/MSDs	No. of Field Blanks	No. of Equipment Blanks	No. of VOA Trip Blanks	No. of PT Samples	Total No. of Samples to Lab
Soil	TPH-purgeable	TBD[b]	1 FD per 10 samples	1 per 20 samples	1 per lot	1 per day per equipment	Not applicable	Not applicable	TBD[b]
Soil	TPH-extractable	TBD[b]	1 FD per 10 samples	1 per 20 samples	1 per lot	1 per day per equipment	Not applicable	Not applicable	TBD[b]
Soil	Metals	TBD[b]	1 FD per 10 samples	1 per 20 samples	1 per lot	1 per day per equipment	Not applicable	Not applicable	TBD[b]
Soil	Asbestos	TBD[b]	1 FD per 10 samples	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[b]
Soil Waste Samples									
Soil	Gamma-emitting isotopes	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Soil	VOCs	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Soil	SVOCs	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Soil	Pesticides	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Soil	PCBs	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Soil	TPH-purgeable	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Soil	TPH-extractable	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Soil	Metals	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]

SAP Worksheet #20 – Field Quality Control Sample Summary Table (Continued)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates (FD) or Laboratory Duplicates (LD)	No. of MS/MSDs	No. of Field Blanks	No. of Equipment Blanks	No. of VOA Trip Blanks	No. of PT Samples	Total No. of Samples to Lab
Wastewater Samples									
Water	Gamma-emitting isotopes	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Water	VOCs	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Water	SVOCs	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Water	Pesticides	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Water	PCBs	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Water	TPH-purgeable	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Water	TPH-extractable	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Water	Herbicides	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Water	Metals	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Water	Oil and grease	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Water	TRPH	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Water	TSS	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]

SAP Worksheet #20 – Field Quality Control Sample Summary Table (Continued)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates (FD) or Laboratory Duplicates (LD)	No. of MS/MSDs	No. of Field Blanks	No. of Equipment Blanks	No. of VOA Trip Blanks	No. of PT Samples	Total No. of Samples to Lab
Water	pH	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Water	Ignitability	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Water	COD	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Water	Total and Dissolved sulfide	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Water	Cyanide	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]
Water	Phenols	TBD[c]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	TBD[c]

Notes:

[a] The number of locations cannot be determined until excavation of piping and thus the length and size of piping and trench are determined. However, each location will be numbered sequentially and with nomenclature that identifies it as piping or postexcavation trench wall/floor samples.

[b] The number of import fill samples will be determined in the field based on the number of import material sources samples. Import material samples will be identified with the source name and a sequential number.

[c] The number of waste samples will be determined in the field based on the amount of soil excavated and wastewater generated. Each waste will be identified with a sequential number and nomenclature identifying the waste from a stockpile, drum, bin, or other container.

SAP Worksheet #21 – Project Sampling SOP References Table

Sampling SOPs are not used for this project. Instead, the details of the sampling procedures associated with this project are included in Worksheet #14.

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SAP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference	Comments
Ludlum Mod 3 or 12 Meter w/ 44-9 detector (or equivalent); Ludlum Model 19 (or equivalent); Ludlum 2350-1 w/ 44-10 detector (or equivalent); Ludlum 2360 w/ 43-68 detector (or equivalent); Ludlum 2360 w/ 43-89 detector (or equivalent); Eberline Model RO-20 (or equivalent); GR 135 Exploranium (or equivalent); Ludlum Model 177 w/ HP-210 detector (or equivalent)	1. Calibrate at lab featuring NIST traceable standards 2. Operational checks and verifications	1. Annually 2. Daily	1. Pass/fail 2. +/- 20% of baseline response criteria	1. If recalibration fails, then instrument combo is retained/exchanged by instrument vendor. 2. If checks and verifications fail, then instrument combo is placed OOS/returned to instrument vendor for repair/exchange. Subsequently, data collected with instrument since previous QC check will be reviewed.	Site Instrument Mechanic under oversight of HP Supervisor (under oversight of project/ license RSO)	HPO-Tt-007	None

SAP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection Table (Continued)

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference	Comments
F&J High/Lo Vol Air Sampler (or equivalent	1. Calibrate at lab featuring manufacturer air flow acceptance standards and equipment 2. Operational checks and verifications	1. Annually 2. Daily	Pass/fail	If checks and verifications fail, then instrument combo is placed OOS/returned to instrument vendor for repair/ exchange	Site Instrument Mechanic under oversight of HP Supervisor (under oversight of project/ license RSO)	HPO-Tt-007	None

SAP Worksheet #23 – Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
RCHL-A-05	Determination of Gamma Radioactivity in Various Matrices Using Ortec HpGe Gamma Spectroscopy Detection Systems and Gamma Vision-32 Software Rev. 2, 03/17/10	Definitive	Soil/Sediment – Gamma Emitting Radionuclides	EG&G Ortec Beryllium Window HPGe Gamma Spectroscopy System	NWT	N
RCHL-A-02A	Determination of Gross Alpha and Beta Radioactivity on Smears and Air Sample Filters Using Protean Gas Proportional Counting System WPC 9550 Rev. 1, 01/30/09	Screening	Swipe – Alpha, Beta/gamma Emitting Radionuclides	Protean Gas Proportional Counting System WPC 9550	NWT	N
ST-RD-0403	Determination of Gross Alpha/Beta Activity Low Background Gas Flow Proportional Counting System Analysis Rev. 10, 04/28/10	Definitive	Swipe – Alpha/beta-emitting radionuclides	Gas Proportional Counter	TestAmerica-St. Louis	N
ST-RD-0403	Low Background Gas Flow Proportional Counting System Analysis Rev. 10, 4/28/10	Definitive	Soil/Water – Strontium-90	Gas Flow Proportional Counter	TestAmerica-St. Louis	N
ST-RD-0102	GammaVision Analysis Rev. 6, 07/31/09	Definitive	Soil – Gamma Isotopes Water – Radium-226	Gamma Spectrometer	TestAmerica-St. Louis	N
ST-RD-0210	Alpha Spectroscopy Analysis Rev. 6, 06/02/09	Definitive	Soil/Water – Isotopic Uranium/Thorium	Alpha Spectrometer	TestAmerica-St. Louis	N
ST-RD-0302	Liquid Scintillation Counter Analysis Rev. 11, 07/31/09	Definitive	Soil/Water – Tritium	Liquid Scintillation Counter	TestAmerica-St. Louis	N

SAP Worksheet #23 – Analytical SOP References Table (Continued)

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
ST-MS-0002	Determination of Volatile Organics by GC/MS Rev. 13, 06/30/09	Definitive	Soil/Water	GC/MS	TestAmerica-St. Louis	N
ST-GC-0014	Aromatic Volatiles and Volatile Petroleum Hydrocarbons by GC PID/FID Rev. 9, 6/04/10	Definitive	Soil/Water	GC/PID	TestAmerica-St. Louis	N
ST-MS-0001	GC/MS Semi-Volatile Analysis Rev.11, 1/31/10	Definitive	Soil/Water	GC/MS	TestAmerica-St. Louis	N
ST-GC-0016	Pesticide Gas Chromatographic Analysis Rev. 11, 02/05/10	Definitive	Soil/Water	GC	TestAmerica-St. Louis	N
ST-GC-0015	PCB GC Analysis Rev. 8, 10/01/09	Definitive	Soil/Water	GC	TestAmerica-St. Louis	N
ST-GC-0005	Extractable Total Petroleum Hydrocarbons by GC-FID Rev. 14, 04/17/09	Definitive	Soil/Water	GC/FID	TestAmerica-St. Louis	N
ST-MT-0001	Analysis of Metals by Inductively Coupled Plasma Mass Spectroscopy Rev. 17, 5/21/10	Definitive	Soil/Water	ICP-MS	TestAmerica-St. Louis	N
ST-MT-0005 ST-MT-0007	Preparation and Analysis of Mercury in Aqueous Samples by CVAA, Rev. 7, 08/21/09 Preparation and Analysis of Mercury in Solid Samples by CVAA, Rev. 8, 08/03/09	Definitive	Soil/Water	Cold Vapor AA	TestAmerica-St. Louis	N
SOP III-A	Asbestos SOP III-A	Definitive	Soil	Microscopy	AmeriSci	N
ST-GC-0017	Herbicide Gas Chromatographic Analysis Rev. 8, 4/28/10	Definitive	Water	GC	TestAmerica-St. Louis	N

SAP Worksheet #23 – Analytical SOP References Table (Continued)

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
ST-WC-0039	N-Hexane Extractable Material and Silica Treated N-Hexane Material by Extraction and Gravimetry Rev. 6, 04/30/10	Definitive	Water	Gravimetric	TestAmerica-St. Louis	N
ST-WC-0036	Determination of Solids in Water and Waste Rev. 9, 04/02/10	Definitive	Water	Gravimetric	TestAmerica-St. Louis	N
ST-WC-00112	pH Analysis in Water and Soil Rev. 12, 11/06/09	Definitive	Water	Electrode	TestAmerica-St. Louis	N
ST-WC-0026	Flashpoint by Pensky-Martens Closed Cup Tester/Cleveland Open Cup Rev. 10, 3/19/10	Definitive	Water	Pensky-Marten Closed Cup	TestAmerica-St. Louis	N
ST-WC-0004	Chemical Oxygen Demand Rev. 9, 10/30/09	Definitive	Water	HACH	TestAmerica-St. Louis	N
ST-WC-0012	Analysis of Sulfide Rev. 9, 02/25/10	Definitive	Water	Titration	TestAmerica-St. Louis	N
ST-WC-0002	Cyanide Analysis by Technicon Traacs 800 Autoanalyzer Rev. 13, 05/28/10	Definitive	Water	Traacs	TestAmerica-St. Louis	N
ST-WC-0017	Phenolics, Total Recoverable Rev. 7, 04/30/10	Definitive	Water	Spectrophotometer	TestAmerica-St. Louis	N

Notes:

[a] Analytical SOP revision number and date listed are current as of the date this SAP was published.

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SAP Worksheet #24 – Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
EG&G Ortec Beryllium Window HPGe Gamma Spectroscopy System	Ortec Gamma Vision-32 A66-B32 Operations Manual	Annual, after maintenance and at the request of the lab manager	+/- 10% for the radionuclides used for calibration	• Recalibration • Instrument maintenance • Notify lab manager	NWT Laboratory Manager	RCHL-A-05
Protean Gas Proportional Counting System WPC 9550	IPC 9025 Operations Manual, Protean Instrument Manual	Annual, after maintenance and at the request of the lab manager	+/- 10% for the radionuclides used for calibration	• Recalibration • Instrument maintenance • Notify lab manager	NWT Laboratory Manager	RCHL-A-02A
Gas Flow Proportional Counter	• Plateau generation and/or verification • Discriminator setting • Initial long background count • Mass attenuated efficiency calibration • Eight source dual/single calibration curves	Annual	• Plot efficiencies vs masses • Calculate equation of curve – degree ≤3 • Remove outliers >15% deviation from theoretical values but not more than 20% of total points • Calculate coefficient of determination (R^2). R^2 must be ≥0.9 • Verify calibration with second source standard count – must be within 30 percent of true value and mean across all detectors <10%	• Recalibrate • Instrument maintenance • Consult with Technical Director	TestAmerica-St. Louis Group Leader	ST-RD-0403

SAP Worksheet #24 – Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gamma Spectrometer	1. Energy calibration 2. FWHM calibration 3. Background	1. Annual 2. Annual 3. Monthly	For Energy and FWMH calibration: • Within 0.5% or 0.1KeV for all calibration points • Within 8% for all calibration points • Verify with second source that always contains at least Am-241, Co-60, and Cs-137 • Must be ± 10%D for each nuclide For Background, acceptance criterion is 12 hours	• Recalibrate • Instrument maintenance • Consult with Technical Director	TestAmerica-St. Louis Group Leader	ST-RD-0102
Alpha Spectrometer	1. Energy calibration 2. Efficiency calibration and background check 3. Subtraction spectrum 4. Pulser check and background check	1. Monthly 2. Monthly 3. Monthly 4. Daily	1. Three isotopes in 3–6 MeV range all within ± 40 KeV of expected value 2. >20% 3. Ultra Low Level: < 2 CPM Low Level: < 2–4 CPM Routine Level: < 4–10 CPM High Level: < 10–20 CPM 4. Pulser energy, peak centroid, peak resolution, peak area, calibration and background must pass statistical "boundary" out-of-range test	• Recalibrate • Instrument maintenance • Consult with Technical Director • If background check is > 20 CPM, then detector requires maintenance	TestAmerica-St. Louis Group Leader	ST-RD-0210

SAP Worksheet #24 – Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Liquid Scintillation Counter	1. Statistical baseline for C-14 and H-3 backgrounds and efficiencies 2. Check of C-14 and H-3 backgrounds and efficiencies 3. Quench curve for specific nuclide	1. Startup or long-term use 2. Daily 3. Annual	1. Developed with statistical limits at time of startup 2. Within 3 sigma of baseline established at startup or when re-established 3. Second source verification ± 10% of true value	• Recalibrate • Instrument maintenance • Consult with Technical Director	TestAmerica-St. Louis Group Leader	ST-RD-0302
GC/MS	Initial Calibration (ICAL) – five-point ICAL	Initial calibration prior to sample analysis	%RSD<20% all compounds, Relative Response Factor meet method criteria	Repeat calibration	TestAmerica-St. Louis Analyst	ST-MS-0002
GC/MS	Second source calibration verification	Once after each initial calibration	Value of second source for all analytes within ±30% of expected	Rerun ICV one time, second failure requires re-calibration	TestAmerica-St. Louis Analyst	ST-MS-0002
GC/MS	Calibration Verification (CV)	Daily, before sample analysis, and every 12 hours of analysis time	+/- 20%D criteria for all analytes	Re-inject CV; if passes rerun previous 10 samples and continue run; if 2nd CV fails, recalibrate	TestAmerica-St. Louis Analyst	ST-MS-0002
GC/PID	Initial Calibration (ICAL) – five-point ICAL	Initial calibration prior to sample analysis	Linear-mean RSD ≤ 20%	Repeat calibration	TestAmerica-St. Louis Analyst	ST-GC-0014
GC/PID	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 15% of expected	Rerun ICV one time, second failure requires re-calibration	TestAmerica-St. Louis Analyst	ST-GC-0014

SAP Worksheet #24 – Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/PID	Calibration Verification (Initial [ICV] and continuing [CCV])	ICV: Daily, before sample analysis CCV: Every 12 hours of analysis time and at the end of the analysis sequence	All analytes within ± 15% of expected value from the ICAL	Re-inject CCV – if passes rerun previous 10 samples and continue run; if 2nd CCV fails, recalibrate	TestAmerica-St. Louis Analyst	ST-GC-0014
GC/MS	Initial Calibration (ICAL) – five-point ICAL	Initial calibration prior to sample analysis	%RSD<20% all compounds, Relative Response Factor meet method criteria	Repeat calibration	TestAmerica-St. Louis Analyst	ST-MS-0001
GC/MS	Second source calibration verification	Once after each initial calibration	Value of second source for all analytes within ±30% of expected	Rerun ICV one time, second failure requires re-calibration	TestAmerica-St. Louis Analyst	ST-MS-0001
GC/MS	Calibration Verification (CV)	Daily, before sample analysis, and every 12 hours of analysis time	+/- 20%D criteria for all analytes	Re-inject CV; if passes rerun previous 10 samples and continue run; if 2nd CCV fails, recalibrate	TestAmerica-St. Louis Analyst	ST-MS-0001
GC/MS	Initial Calibration (ICAL) – five-point ICAL	Initial calibration prior to sample analysis	%RSD<20% all compounds, Relative Response Factor meet method criteria	Repeat calibration	TestAmerica-St. Louis Analyst	ST-MS-0001
GC/MS	Second source calibration verification	Once after each initial calibration	Value of second source for all analytes within ±30% of expected	Rerun ICV one time, second failure requires re-calibration	TestAmerica-St. Louis Analyst	ST-MS-0001
GC/MS	Calibration Verification (CV)	Daily, before sample analysis, and every 12 hours of analysis time	+/- 20%D criteria for all analytes	Re-inject CV; if passes rerun previous 10 samples and continue run; if 2nd CCV fails, recalibrate	TestAmerica-St. Louis Analyst	ST-MS-0001
GC	Initial Calibration (ICAL) – five-point ICAL	Initial calibration prior to sample analysis	RSD for each analyte ≤ 20%	Repeat calibration	TestAmerica-St. Louis Analyst	ST-GC-0016

SAP Worksheet #24 – Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 20% of expected value (initial source)	Rerun ICV one time, second failure requires re-calibration	TestAmerica-St. Louis Analyst	ST-GC-0016
GC	Calibration Verification (Initial [ICV] and continuing [CCV])	ICV: Daily, before sample analysis CCV: After every 12 hours of analysis time and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	Re-inject CCV; if passes rerun previous 10 samples and continue run; if 2nd CCV fails, recalibrate	TestAmerica-St. Louis Analyst	ST-GC-0016
GC	Initial Calibration (ICAL) – five-point ICAL	Initial calibration prior to sample analysis	Mean RSD for each PCB ≤ 20%	Recalibrate	TestAmerica-St. Louis Analyst	ST-GC-0015
GC	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 20% of expected value (initial source)	Rerun ICV one time, second failure requires re-calibration	TestAmerica-St. Louis Analyst	ST-GC-0015
GC	Calibration Verification (Initial [ICV] and continuing [CCV])	ICV: Daily, before sample analysis CCV: After every 12 hours of analysis time and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	Re-inject CCV; if passes rerun previous 10 samples and continue run; if 2nd CCV fails, recalibrate	TestAmerica-St. Louis Analyst	ST-GC-0015
GC/FID	Initial Calibration (ICAL) – five-point ICAL	Initial calibration prior to sample analysis	Linear mean RSD ≤ 20%	Recalibrate	TestAmerica-St. Louis Analyst	ST-GC-0005
GC/FID	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 25% of expected value (initial source)	Rerun ICV one time, second failure requires re-calibration	TestAmerica-St. Louis Analyst	ST-GC-0005

SAP Worksheet #24 – Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC/FID	Calibration Verification (Initial [ICV] and continuing [CCV])	ICV: Daily, before sample analysis CCV: Every 12 hours of analysis time and at the end of the analysis sequence	All analytes within ± 15% of expected value from the ICAL	Re-inject CCV; if passes rerun previous 10 samples and continue run; if 2nd CCV fails, recalibrate	TestAmerica-St. Louis Analyst	ST-GC-0005
ICP-MS	Initial Calibration (ICAL) – minimum one high standard and a calibration blank	Daily initial calibration prior to sample analysis	3 standards and a blank. Correlation Coefficient of ≥ 0.998	Recalibrate	TestAmerica-St. Louis Analyst	ST-MT-0001
ICP-MS	Second Source Calibration Verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected	Recalibrate	TestAmerica-St. Louis Analyst	ST-MT-0001
ICP-MS	Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence	All analytes within + 10% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	TestAmerica-St. Louis Analyst	ST-MT-0001
Cold Vapor AA	Initial Calibration (ICAL)	Daily initial calibration prior to sample analysis	Correlation coefficient R>=0.995 for linear regression	Recalibrate	TestAmerica-St. Louis Analyst	ST-MT-0005 ST-MT-0007
Cold Vapor AA	Second Source Calibration Verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analyte(s) within ± 10% of expected value (second source)	Recalibrate	TestAmerica-St. Louis Analyst	ST-MT-0005 ST-MT-0007
Cold Vapor AA	Continuing Calibration Verification (CCV)	After every 10 samples and at the end of the analysis sequence.	All analytes within + 20% of expected value	Recalibrate – rerun 10 samples previous to failed CCV.	TestAmerica-St. Louis Analyst	ST-MT-0005 ST-MT-0007

SAP Worksheet #24 – Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
GC	Initial Calibration (ICAL) – five-point ICAL	Initial calibration prior to sample analysis	Mean RSD for each herbicide ≤ 20%	Recalibrate	TestAmerica-St. Louis Analyst	ST-GC-0017
GC	Second Source Calibration Verification	Once after each initial calibration	Value of second source for all analytes within ± 30% of expected value (initial source)	Rerun ICV one time, second failure requires re-calibration	TestAmerica-St. Louis Analyst	ST-GC-0017
GC	Calibration Verification (Initial [ICV] and Continuing [CCV])	ICV: Daily, before sample analysis CCV: After every 12 hours of analysis time and at the end of the analysis sequence	All analytes within ± 20% of expected value from the ICAL	Re-inject CCV; if passes rerun previous 10 samples and continue run; if 2nd CCV fails, recalibrate	TestAmerica-St. Louis Analyst	ST-GC-0017
Gravimetric	Initial Calibration	Daily	The analytical balance used must be calibrated daily. The balance needs to be calibrated at 2 mg and 1000 mg and calibration must be within 10%.	Recalibrate	TestAmerica-St. Louis Analyst	ST-WC-0039
Gravimetric	Initial Calibration	Daily	The analytical balance used must be calibrated daily. The weights used for the calibration must bracket the expected range of use. The lower calibration weight must be a maximum of 200 mg.	Recalibrate	TestAmerica-St. Louis Analyst	ST-WC-0036
Electronic Probe	Initial Calibration	Prior to sample analysis	A three point calibration is performed. Buffer solutions of 4, 7, and 10 are used. Readings must be within ±0.05 for each buffer solution.	Recalibrate	TestAmerica-St. Louis Analyst	ST-WC-0011

SAP Worksheet #24 – Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Electronic Probe	Continuing Calibration	Check the calibration by analyzing the calibration check standard (pH 7 buffer) after the initial calibration, every ten samples, and at the end of the analytical run	pH reading must be within ±0.05 of the ph 7 buffer.	Recalibrate – rerun samples bracketed by failing CCV	TestAmerica-St. Louis Analyst	ST-WC-0011
Pensky-Marten Closed Cup	Initial Calibration	Annual	Thermometers are verified annually. Rotation apparatus verified annually.	Maintenance required	TestAmerica-St. Louis Analyst	ST-WC-0026
Pensky-Marten Closed Cup	Calibration Check	Prior to running samples	The flash point of a check standard (P-Xylene) must be obtained within a value of 27.2 ± 1.1°C	Re-run check	TestAmerica-St. Louis Analyst	ST-WC-0026
Pensky-Marten Closed Cup	Continuing Calibration Check (second source)	Every 10 samples	Control limit is 27.2 ± 1.1°C.	Recalibrate – rerun samples bracketed by failing CCV	TestAmerica-St. Louis Analyst	ST-WC-0026
HACH	Calibration	Annually the working range of the instrument calibration must be verified with a 5 point calibration.	Each point must read within +/- 5% of its' true value.	Instrument maintenance required	TestAmerica-St. Louis Analyst	ST-WC-0004
HACH	Calibration Check	The low-level LCS and high-level LCS serve as calibration checks.	The calibration check acceptance criteria 90%–110%. Run at beginning and end of the run.	Recalibrate – rerun samples	TestAmerica-St. Louis Analyst	ST-WC-0004

SAP Worksheet #24 – Analytical Instrument Calibration Table (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Titration	Calibration Check	The low-level LCS and high-level LCS serve as calibration checks.	The calibration check acceptance criteria 90%–110%. Run at beginning and end of the run.	Recalibrate – rerun samples	TestAmerica-St. Louis Analyst	ST-WC-0012
Traacs	Initial Calibration	Daily – minimum of 5 points	Correlation coefficient of 0.995 or greater	Recalibrate	TestAmerica-St. Louis Analyst	ST-WC-0002
Traacs	ICV	Immediately after the last calibration standard	+/- 15% of true value	Recalibrate	TestAmerica-St. Louis Analyst	ST-WC-0002
Traacs	CCV	Every 10 samples during the sequence and after the last analytical sample.	± 10% of true value. The high and low distilled check standard must be ± 10%	Recalibrate and reanalyze all analytical samples analyzed since the last compliant CCV	TestAmerica-St. Louis Analyst	ST-WC-0002
Spectrophotometer	Initial Calibration	Daily – minimum of 5 points	Acceptable calibration must have a correlation coefficient ≥ 0.995	Recalibrate	TestAmerica-St. Louis Analyst	ST-WC-0017
Spectrophotometer	ICV	Immediately after the last calibration standard	Acceptance limit is 85% – 115%.	Recalibrate	TestAmerica-St. Louis Analyst	ST-WC-0017
Spectrophotometer	CCV	Every 10 samples during the sequence and after the last analytical sample.	The CCV must be within the 15%D criteria	Recalibrate and reanalyze all analytical samples analyzed since the last compliant CCV	TestAmerica-St. Louis Analyst	ST-WC-0017

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SAP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
EG&G Ortec Beryllium Window Gamma Spectroscopy System	Clean cave; fill LNO2	Physical check	Physical check	Weekly	Acceptable background	• Recalibrate • Instrument maintenance • Consult lab manager	NWT Laboratory Manager	RCHL-A-05
	Background check/Check deviation	Physical check	Physical check	Prior to use and at minimum daily	Within 3 sigma of measured population	• Recalibrate • Instrument maintenance • Consult lab manager	NWT Laboratory Manager	RCHL-A-05
	Source check/Check deviation	Physical check	Physical check	Prior to use and at minimum daily	Within 3 sigma of measured population	• Recalibrate • Instrument maintenance • Consult lab manager	NWT Laboratory Manager	RCHL-A-05
Protean Gas Proportional Counting System WPC 9550	Alpha source check/check deviation	Physical check	Physical check	Prior to use and at minimum daily	Within 3 sigma of measured population	• Recalibrate • Instrument maintenance • Consult lab manager	NWT Laboratory Manager	RCHL-A-02A
	Beta source check/check deviation	Physical check	Physical check	Prior to use and at minimum daily	Within 3 sigma of measured population	• Recalibrate • Instrument maintenance • Consult lab manager	NWT Laboratory Manager	RCHL-A-02A
	Background blank/check deviation	Physical check	Physical check	Prior to use and at minimum daily	Within 3 sigma of measured population	• Recalibrate • Instrument maintenance • Consult lab manager	NWT Laboratory Manager	RCHL-A-02A
	P10 gas supply	Physical check	Physical check	Daily	Adequate	Resupply	NWT Laboratory Manager	RCHL-A-02A

SAP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (Continued)

Instrument Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Gas Flow Proportional Counter	1. Clean instrument 2. Inspect windows 3. QA check	1. Physical check 2. Physical check 3. Background and source count	1. Physical check 2. Physical check 3. Check deviation	1. Daily 2. High counts and/or background 3. Daily	1. None applicable 2. No physical defects 3. Within 3 sigma of 20 day population	• Recalibrate • Instrument maintenance • Consult with Technical Director	TestAmerica-St. Louis Group Leader / Analyst	ST-RD-0403
Gamma Spectrometer	1. Clean cave; fill dewar with N_2 2. QA check	1. Physical check 2. Background and source check	1. Physical check 2. Check deviation	1. Weekly 2. Daily	1. Acceptable background 2. Within 3 sigma of measured population	• Recalibrate • Instrument maintenance • Consult with Technical Director	TestAmerica-St. Louis Group Leader / Analyst	ST-RD-0102
Alpha Spectrometer	Clean planchette holders	Physical check	Physical check	Monthly	Acceptable background and calibration efficiencies	• Recalibrate • Instrument maintenance • Consult with Technical Director	TestAmerica-St. Louis Group Leader / Analyst	ST-RD-0210
Liquid Scintillation Counter	1. QA check 2. Clean dust and debris from sample deck 3. Photon multiplier tubes cleaned by manufacturer	1. Background and efficiency verification for C-14 and H-3 2. Physical check 3. Physical check	1. Review of daily control data 2. Physical check 3. Physical check	1. Daily 2. Monthly 3. Semi-annual or annual	For all three maintenance activities: within 3 sigma of established baselines and stable baselines for C-14 and H-3 efficiencies	• Recalibrate • Instrument maintenance • Consult with Technical Director	TestAmerica-St. Louis Group Leader / Analyst	ST-RD-0302

SAP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (Continued)

Instrument Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
GCMS GC ICP-MS Cold Vapor AA	Parameter Setup	Physical check	Physical check	Initially; prior to DCC	Predetermined optimum parameter settings	Reset if incorrect	TestAmerica-St. Louis Analyst	ST-MS-0002, ST-GC-0014, ST-MS-0001, ST-GC-0015, ST-GC-0005, ST-MT-0001, ST-MT-0005, ST-MT-0007
GC/MS	Tune Check	Instrument Performance	Conformance to instrument tuning	Initially; prior to DCC	Compliance to ion abundance criteria	Repeat tune check to rule out standard degradation or inaccurate injection. If problem persists, perform retune the instrument and repeat tune check.	TestAmerica-St. Louis Analyst	ST-MS-0002, ST-MS-0001
ICP-MS	ICS	Instrument Performance	Conformance to interference check	Prior to sample analysis	Within + 20% of expected value	Terminate analysis, reanalyze ICS to rule out standard degradation or inaccurate injection. If problem persists, perform instrument maintenance, repeat calibrations and reanalyze all associated samples.	TestAmerica-St. Louis Analyst	ST-MT-0001

SAP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (Continued)

Instrument Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
ICP-MS	ICB/CCB	Instrument Performance	Instrument contamination check	After every calibration verification	ICB:No analytes detected > RL; CCB: no analyte detected > 3X MDL	Determine possible source of contamination and apply appropriate measure to correct the problem. Reanalyze calibration blank and all associated samples.	TestAmerica-St. Louis Analyst	ST-MT-0001
Cold Vapor AA	ICB/CCB	Instrument Performance	Instrument contamination check	After every calibration verification	No analytes detected > RL	Determine possible source of contamination and apply appropriate measure to correct the problem. Reanalyze calibration blank and all associated samples.	TestAmerica-St. Louis Analyst	ST-MT-0005 ST-MT-0007
Balance	Clean and inspect balance weight check	Daily weight checks	Physical check	Daily	Meet method criteria	Clean balance; contact repair service; reanalyze any affected samples	TestAmerica-St. Louis Analyst	ST-WC-0039, ST-WC-0036
Oven	Clean and inspect	Daily temp checks	Physical check	Day of use	Meet method criteria	Check temp settings – adjust as needed; contact repair service; reanalyze any affected samples	TestAmerica-St. Louis Analyst	ST-WC-0036
Probe	Clean and inspect	Performance	QC check	Day of use	Meet method criteria	Clean probe; reanalyze any affected samples	TestAmerica-St. Louis Analyst	ST-WC-0011
Flashpoint apparatus	Clean and inspect – annual check of rotator	Performance	QC check	Day of use	Meet method criteria	Call for repair; reanalyze any affected samples	TestAmerica-St. Louis Analyst	ST-WC-0026

SAP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (Continued)

Instrument Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
HACH	Maint. Not applicable – kits bought from vendor.	Performance	QC check	Day of use	Meet method criteria	Replace; reanalyze any affected samples	TestAmerica-St. Louis Analyst	ST-WC-0004
Titration	Visual inspection of glassware used; pipette calibration	Performance	QC check	Day of use	Meet method criteria	Replace; reanalyze any affected samples	TestAmerica-St. Louis Analyst	ST-WC-0012
TRAACS	Check air pressure, change tubing as needed, finish run with wash out	Performance	QC check	Day of use	Meet method criteria	Contact repair service – reanalyze any affected samples.	TestAmerica-St. Louis Analyst	ST-WC-0002
Spectrophotometer	Change membrane as needed	Performance	QC check	Day of use	Meet method criteria	Contact repair service – reanalyze any affected samples.	TestAmerica-St. Louis Analyst	ST-WC-0017

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SAP Worksheet #26 – Sample Handling System

Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Sampler / TtEC
Sample Packaging (Personnel/Organization): Sampler / TtEC
Coordination of Shipment (Personnel/Organization): Sampler / TtEC
Type of Shipment/Carrier: Courier or FedEx®
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Custodian / NWT or TestAmerica-St. Louis
Sample Custody and Storage (Personnel/Organization): Sample Custodian / NWT or TestAmerica-St. Louis
Sample Preparation (Personnel/Organization): Sample preparation personnel / NWT or TestAmerica-St. Louis
Sample Determinative Analysis (Personnel/Organization): Analyst / NWT or TestAmerica-St. Louis
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 90 calendar days
Sample Extract/Digestate Storage (No. of days from extraction/digestion): up to 40 calendar days depending on method holding times
Biological Sample Storage (No. of days from sample collection): N/A
SAMPLE DISPOSAL
Personnel/Organization: Sample Custodian / NWT or TestAmerica-St. Louis
Number of Days from Analysis: N/A (Samples are archived at the project site.)

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SAP Worksheet #27 – Sample Custody Requirements Table

An overriding consideration for data resulting from laboratory analyses is the ability to demonstrate that the data are legally defensible, i.e., that the samples were obtained from the locations stated and that they reached the laboratory without alteration. To accomplish this, evidence of collection, shipment, laboratory receipt, and laboratory custody until disposal will be documented through the COC record. A sample is considered to be in custody if the following conditions have been observed:

- In actual possession or in view of the person who collected the samples
- Locked in a secure area
- Placed in an area restricted to authorized personnel
- Placed in a container and secured with an official seal, so that the sample cannot be reached without breaking the seal

Attachment 1 presents an example of the COC record. The COC record lists each sample and the individuals performing the sample collection, shipment, and receipt. Attachment 1 presents an example of a custody seal that will seal samples and the cooler during transportation to the laboratory.

The COC record will be the controlling document to ensure that the sample custody is maintained. Typically, the COC will be prepared and produced by the approved TtEC COC database program prior to sample collection. Exceptions to the use of the COC database program are limited and may include pipe or manhole sediment samples collected in the field immediately upon excavation. Each time the sample custody is transferred, the former custodian will sign the COC on the _Relinquished By_ line, and the new custodian will sign the COC on the _Received By_ line. The date, time, and project or company affiliation will accompany each signature. The waybill number and courier name will be recorded on the COC when FedEx is used. The shipping container will be secured with two custody seals, thereby allowing for custody to be maintained by the shipping personnel until receipt by the laboratory.

Sample custody will be the responsibility of sampling personnel from the time of sample collection until the samples are accepted by the laboratory via courier or FedEx. Thereafter, the laboratory performing the analysis will maintain custody. The sample custodian will sign the COC from the courier or FedEx, inventory each shipment, and note on the original COC record any discrepancy in the sample custody, temperature of the cooler, or broken sample containers. The laboratory will note discrepancies on the sample receipt form. The laboratory project manager will immediately notify the Project Chemist. The Project Chemist, in consultation with the project team, will provide instructions in writing to the laboratory. The laboratory will have a system for tracking samples consistent with Section 5.8 of the Quality Systems Manual (QSM) (DoD 2006). The laboratory will archive the samples and maintain their custody up to 90 calendar days after sample collection, at which time the samples will be disposed of by the laboratory.

SAP Worksheet #27 – Sample Custody Requirements Table (Continued)

In addition to providing a custody exchange record for the samples, the COC record serves as a formal request for sample analyses. The COC records will be completed, signed, and distributed as follows:

- Two copies sent to the analytical laboratory with the sample shipment
- One copy retained on-site for inclusion in the project files
- A copy faxed/e-mailed to the Project Chemist on a daily basis to allow tracking of samples during shipment and confirm laboratory receipt of samples
- One copy sent to the Project Chemist

SAMPLE NUMBERING

Samples will be uniquely designated using a numbering system that identifies the type of sample and a sequential number (i.e., 28-001). Sample numbers will be generated by the TtEC COC Database Program with the exception of pipe/manhole sediment samples.

The sample number will be recorded in the field logbook, on the labels, and the COC record at the time of sample collection. A complete description of the sample and sampling conditions will be recorded in the field logbook and referenced using the unique sample identification number. The sample number scheme will be as follows:

For nonradiological samples, samples will be numbered as follows:

WW-PX-IRYY-ZZZZ, where:
WW – CTO or Task Order (TO) number
P – Abbreviation for Parcel
X – Parcel designation (e.g., A for Parcel A, B for Parcel B, etc.)
IR – Abbreviation for Installation Restoration
YY – Two-character designation for Installation Restoration (IR) site number
ZZZZ – consecutive number begins with 0001 for this project and continues consecutively throughout the project with no repeated numbers

For radiological samples, numbering schemes for RSY survey pads, pipe sediment, manhole sediment, pipe/manhole swipes, extraneous pipe sediment and swipes, trench survey units, import fill material, and waste bins will be used. Other numbering schemes as approved by the RSO may be used for special circumstances. The typical radiological sample numbering schemes are as follows:

- RSY Survey Pads: **WW-PX-AQQQQ-UU**, where:

  WW – CTO or TO number
  P – Abbreviation for Parcel
  X – Parcel designation (e.g., A for Parcel A, B for Parcel B, etc.)
  A – Identifier to indicate that the sample is from a survey pad

SAP Worksheet #27 – Sample Custody Requirements Table (Continued)

QQQQ – Four-character consecutive pile number that begins with 0001 for this project and continues consecutively throughout the project with no repeated numbers
UU – Two-character consecutive sample number starting with 01 (number of samples collected from each survey pad)

- Reference Area: **WW-PX-RA-UU**, where:

  WW – CTO or TO number
  P – Abbreviation for Parcel
  X – Parcel designation (e.g., A for Parcel A, B for Parcel B, etc.)
  RA – Identifier to indicate that the sample is reference area sample
  UU – Two-character consecutive sample number starting with 01 (number of samples collected from each reference area)

- Pipe Sediment: **WW-PXPI-QQQQ-UU**, where:

  WW – CTO or TO number
  P – Abbreviation for Parcel
  X – Parcel designation (e.g., A for Parcel A, B for Parcel B, etc.)
  PI – Abbreviation to indicate a pipe sediment sample
  QQQQ – Four-character consecutive sample number that begins with 0001 for this project and continues consecutively throughout the project with no repeated numbers
  UU – Two-character consecutive sample number starting with 01 (number of sediment samples collected from each pipe)

- Manhole Sediment: **WW-PXMHYYY-QQQ-UU**, where:

  WW – CTO or TO number
  P – Abbreviation for Parcel
  X – Parcel designation (e.g., A for Parcel A, B for Parcel B, etc.)
  MH – Indicates a manhole sediment sample
  YYY – Three-character manhole identification number
  QQQ – Three-character consecutive sample number that begins with 0001 for this project and continues consecutively throughout the project with no repeated numbers
  UU – Two-character consecutive sample number starting with 01 (number of samples collected from each manhole)

- Pipe/Manhole Swipes: **WW-PXS-YY-AABBCC-SS-UU**, where:

  WW – CTO or task order number
  P – Abbreviation for Parcel
  X – Parcel designation (e.g., A for Parcel A, B for Parcel B, etc.)
  S – Identifier to indicate a swipe sample
  YY – Two-character component identifier (PI – Pipe, MH – Manhole)
  AA – Two-character work area number (06 for Area 6, 10 for Area 10, etc.)
  BB – Two-character identifier for IR site or "00" for non-IR site
  CC – Two-character trench identification number (4A, 8C, 1G, etc.)
  SS – Two-character pipe component number

SAP Worksheet #27 – Sample Custody Requirements Table (Continued)

UU – Two-character consecutive sample number starting with 01 for this project (number of swipes performed for each pipe)

- Extraneous Pipe Sediment and Swipes: **WW-PXS/P-EPYYY-UU**, where

  WW – CTO or task order number
  P – Abbreviation for Parcel
  X – Parcel designation (e.g., A for Parcel A, B for Parcel B, etc.)
  S/P – Use "S" to indicate a swipe sample and use "P" to indicate a sediment sample
  EP – Identifier to indicate an extraneous pipe sample
  YYY – Three-character unique extraneous pipe identifier
  UU – Two-character consecutive sample number starting with 01 for this project (number of swipes performed or sediment samples collected from each pipe)

- Trench Survey Unit: **WW-PXT-YYY-UUU**, where

  WW – CTO or task order number
  P – Abbreviation for Parcel
  X – Parcel designation (e.g., A for Parcel A, B for Parcel B, etc.)
  T – Indicates a trench sample
  YYY – Three-character trench survey unit number
  UUU – Three-character consecutive sample number starting with 001 (number of samples collected from each survey unit)

- Import Fill Material: **WW-BACKFILL-UUU**, where

  WW – CTO or task order number
  UUU – Three-character consecutive sample number starting with 001 (number of samples collected from each survey unit)

- Radiological Waste Bin: **WW-PXB-TYYYYYYYYY-UU**, where

  WW – CTO or task order number
  P – Abbreviation for Parcel
  X – Parcel designation (e.g., A for Parcel A, B for Parcel B, etc.)
  B – Indicates a waste bin sample
  T – Bin manufacturer letter designation (i.e., G-GFLU, C-CVGU, B-BKRU or BFLU)
  YYYYYYYYY – Nine-character waste bin identification number
  UU – Two-character consecutive sample number starting with 01 (number of samples collected from waste bin)

The sample number will be recorded in the field logbook, on the labels, and on the COC record at the time of sample collection. A complete description of the sample and sampling conditions will be recorded in the field logbook and referenced using the unique sample identification number.

SAP Worksheet #27 – Sample Custody Requirements Table (Continued)

SAMPLE PACKAGING

Radiological Samples

Sampling packaging and shipping will be performed in accordance with the SOP HPO-Tt-009 governing sampling procedures for radiological surveys. This SOP will, at a minimum, establish standards and requirements comparable to those in the SOP in Attachment 2.

Chemical Samples

Immediately after sample labeling, custody seals will be affixed to each sample container. Each container will be placed in double-resealable plastic bags to protect the samples from moisture. For VOA vials and En Core samples, the custody seal will be placed on the outside of the first resealable bag; then the containers will be placed in a second resealable bag. This will prevent any contact with the adhesive from the custody seal and the samples. VOA vials will be wrapped with bubble wrap (if transported by a commercial carrier), placed in a resealable bag, and then placed in another resealable bag following application of a custody seal over the first bag.

Samples to be transported to an off-site laboratory will be shipped in coolers. Each cooler will be shipped with a temperature blank. A temperature blank is a container filled with tap water and stored in the cooler during sample collection and transportation. The temperature of the cooler will be recorded by the laboratory on the COC record immediately upon receipt of the samples. Sample cooler drain spouts will be taped from the inside and outside of the cooler to prevent any leakage.

Two custody seals will be taped across the cooler lid: one seal in the front and one seal in the back. The COC record will be completed and signed by the courier. The cooler(s) and the top two copies (white and pink) of the COC record will then be released to the courier for transportation to the laboratory. Samples to be shipped by commercial carrier will be packed in a sample cooler lined with a plastic bag. (All glass sample containers will be protected with bubble wrap, and then placed in resealable bags if transported by a commercial carrier.) Double-bagged ice will be added inside the plastic bag at the bottom of the cooler, one layer of sample containers will be placed on the ice, and more double-bagged ice will be placed on top of the containers. This will be repeated until the cooler is filled with ice as the top layer in the cooler.

The COC record will include the air bill number, and the "Received By" box will be labeled with the commercial courier's name. The top two copies of the COC record will be sealed in a double-resealable bag and then taped to the inside of the sample cooler lid. The cooler will be taped shut with strapping tape. Two custody seals will be taped across the cooler lid: one seal in the front and one seal in the back. Clear tape will be applied to the custody seals to prevent accidental breakage during shipment. The pouch for the air bill will be placed on the cooler and secured with clear tape. The air bill will be completed for priority overnight delivery and placed in the pouch. If multiple coolers are being shipped, the original air bill will be placed on the cooler with the COC record, and copies of the air bill will be placed on the other coolers. The number of packages should be included on each air bill (1 of 2, 2 of 2). Saturday deliveries

SAP Worksheet #27 – Sample Custody Requirements Table (Continued)

should be coordinated with the laboratory in advance, and field sampling personnel or their designee must ensure that Saturday delivery stickers are placed on each cooler by the commercial courier. "Dangerous goods" declarations will also be completed as applicable.

SAP Worksheet #28.1 – Laboratory QC Samples Table – Soil

Matrix: Soil
Analytical Group: Gamma Isotopes
Analytical Method/SOP Reference: Gamma/ RCHL-A-05 (on-site laboratory)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Background Sample	Daily	Absolute value less than analyte RL	[a]	NWT Laboratory Manager	Accuracy	Absolute value less than analyte RL
LCS	Weekly	Gamma source check +/- 20% of known activity	[b]	NWT Laboratory Manager	Accuracy	Gamma source check +/- 20% of known activity
Sample Duplicate	1 per preparatory batch and or every 20 samples	RPD $\leq$30	[d]	NWT Laboratory Manager	Precision	RPD $\leq$30

SAP Worksheet #28.1 – Laboratory QC Samples Table – Soil (Continued)

Matrix: Soil
Analytical Group: Gamma Isotopes
Analytical Method/SOP Reference: EPA 901.1 MOD /SOP ST-RD-0102

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	a	TestAmerica-St. Louis Analyst	Accuracy	Analytes < RL
LCS	1 per preparatory batch	Within in-house limits (Limits are for tuna can LCS geometry until 250 mL Ra-226 geometry is active – Limits for Ra-226 listed are advisory until enough data points are generated to be statistically meaningful)	b	TestAmerica-St. Louis Analyst	Accuracy	Tuna Can: ^{137}Cs: 94–118% ^{60}Co: 90–110% ^{241}Am: 90–110% 250 mL Poly: ^{226}Ra: 70–130%
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	e	TestAmerica-St. Louis Analyst	Accuracy	RPD ≤40% and/or RER ≤1

SAP Worksheet #28.1 – Laboratory QC Samples Table – Soil (Continued)

Matrix: Soil
Analytical Group: Strontium-90
Analytical Method/SOP Reference: EPA 905 MOD or DOE SR-03-RC MOD/SOP ST-RD-0403

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < RL
LCS and/or LCD	1 per preparatory batch	Within in-house limits	[b]	TestAmerica-St. Louis Analyst	Accuracy	EPA 905 MOD: 69–137% DOE SR-03-RC MOD: 69–137% RPD ≤40% and/or RER ≤1
MS/MSD	As requested	Within in-house limits	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	EPA 905 MOD: 70–130% DOE SR-03-RC MOD: 70–130% RPD ≤40% and/or RER ≤1
Carriers	Per sample, blank, LCS, MS, MSD	Sr and Yt carriers ≥40% and ≤110%	[d]	TestAmerica-St. Louis Analyst	Accuracy	Sr and Yt carriers ≥40% and ≤110%
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	[e]	TestAmerica-St. Louis Analyst	Accuracy	RPD ≤40% and/or RER ≤1

SAP Worksheet #28.1 – Laboratory QC Samples Table – Soil (Continued)

Matrix: Soil
Analytical Group: Isotopic Uranium
Analytical Method/SOP Reference: DOE A-01-R MOD/SOP ST-RD-0210

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < RL
LCS and/or LCD	1 per preparatory batch	Within in-house limits	[b]	TestAmerica-St. Louis Analyst	Accuracy	^{234}U: 70–122% ^{238}U: 69–119% RPD ≤40% and/or RER ≤1
MS/MSD	As requested	Within in-house limits	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	^{234}U: 70–130% ^{238}U: 70–130% RPD ≤40% and/or RER ≤1
Tracer	Per sample, blank, LCS, MS, MSD	Within in-house limits	[d]	TestAmerica-St. Louis Analyst	Accuracy	^{232}U: 30–110%
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	[e]	TestAmerica-St. Louis Analyst	Accuracy	RPD ≤40% and/or RER ≤1

SAP Worksheet #28.1 – Laboratory QC Samples Table – Soil (Continued)

Matrix: Soil
Analytical Group: Isotopic Thorium
Analytical Method/SOP Reference: DOE A-01-R MOD/SOP ST-RD-0210

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < RL
LCS	1 per preparatory batch	Within in-house limits	[b]	TestAmerica-St. Louis Analyst	Accuracy	^{230}Th: 83–120% RPD ≤40% and/or RER ≤1
MS/MSD	As requested	Within in-house limits	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	^{230}Th: 70–130% RPD ≤40% and/or RER ≤1
Tracer	Per sample, blank, LCS, MS, MSD	Within in-house limits	[d]	TestAmerica-St. Louis Analyst	Accuracy	^{229}Th: 30–110%
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	[e]	TestAmerica-St. Louis Analyst	Accuracy	RPD ≤40% and/or RER ≤1

SAP Worksheet #28.1 – Laboratory QC Samples Table – Soil (Continued)

Matrix: Soil
Analytical Group: Isotopic Plutonium
Analytical Method/SOP Reference: DOE A-01-R MOD/SOP ST-RD-0210

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	a	TestAmerica-St. Louis Analyst	Accuracy	Analytes < RL
LCS	1 per preparatory batch	Within in-house limits	b	TestAmerica-St. Louis Analyst	Accuracy	^{238}Pu: 64–118 % ^{239}Pu/^{240}Pu: 75–18 % RPD ≤40% and/or RER ≤1
MS/MSD	As requested	Within in-house limits	c	TestAmerica-St. Louis Analyst	Accuracy/ Precision	^{238}Pu: 70–30% ^{239}Pu/^{240}Pu: 70–30% RPD ≤40% and/or RER ≤1
Tracer	Per sample, blank, LCS, MS, MSD	Within in-house limits	d	TestAmerica-St. Louis Analyst	Accuracy	^{242}Pu: 30–10%
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	e	TestAmerica-St. Louis Analyst	Accuracy	RPD ≤40% and/or RER ≤1

SAP Worksheet #28.1 – Laboratory QC Samples Table – Soil (Continued)

Matrix: Soil
Analytical Group: Tritium
Analytical Method/SOP Reference: EPA 906.0 MOD/SOP ST-RD-0302

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < RL
LCS and/or LCD	1 per preparatory batch	Within in-house limits	[b]	TestAmerica-St. Louis Analyst	Accuracy	75–40% RPD ≤40% and/or RER ≤1
MS/MSD	As requested	Within in-house limits	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	62–29% RPD ≤40% and/or RER ≤1
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	[e]	TestAmerica-St. Louis Analyst	Accuracy	RPD ≤40% and/or RER ≤1

SAP Worksheet #28.1 – Laboratory QC Samples Table – Soil (Continued)

Matrix: Soil
Analytical Group: VOCs
Analytical Method/SOP Reference: EPA 8260C/SOP ST-MS-0002

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	1,1-Dichloroethene 65–135% Benzene: 75–125% Chlorobenzene: 75–125% Toluene: 70–125% Trichloroethene: 75–125%	[b]	TestAmerica-St. Louis Analyst	Accuracy	1,1-Dichloroethene 65-135% Benzene: 75–125% Chlorobenzene: 75–125% Toluene: 70–125% Trichloroethene: 75–125%
MS/MSD	1 per preparatory batch per matrix	1,1-Dichloroethene 65–135% Benzene: 75–125% Chlorobenzene: 75–125% Toluene: 70–125% Trichloroethene: 75–125%	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	1,1-Dichloroethene 65-135% Benzene: 75–125% Chlorobenzene: 75–125% Toluene: 70–125% Trichloroethene: 75–125%
Surrogate	Per all field and QC samples	1,2-Dichloroethane-d_4: 80–131% 4-Bromofluorobenzene: 85–20% Toluene-d_8: 85–115%	[d]	TestAmerica-St. Louis Analyst	Accuracy	1,2-Dichloroethane-d_4: 80–131% 4-Bromofluorobenzene: 85–20% Toluene-d_8: 85–115%

SAP Worksheet #28.1 – Laboratory QC Samples Table – Soil (Continued)

Matrix: Soil
Analytical Group: SVOCs
Analytical Method/SOP Reference: EPA 8270D/SOP ST-MS-0001

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	1,2,4–Trichlorobenzene 45–110%	[b]	TestAmerica-St. Louis Analyst	Accuracy	1,2,4-Trichlorobenzene 45–10%
		1,4–Dichlorobenzene 35–105%		TestAmerica-St. Louis Analyst	Accuracy	1,4-Dichlorobenzene 35–05%
		2,4–Dinitrotoluene 50–115%		TestAmerica-St. Louis Analyst	Accuracy	2,4-Dinitrotoluene 50–15%
		Acenaphthene 45–110%		TestAmerica-St. Louis Analyst	Accuracy	Acenaphthene 45–10%
		2–Chlorophenol 45–105%		TestAmerica-St. Louis Analyst	Accuracy	2-Chlorophenol 45–05%
		n–Nitrosodi–n–propylamine 40–115%		TestAmerica-St. Louis Analyst	Accuracy	n-Nitrosodi-n-propylamine 40–15%
		4–Chloro–3–methyl phenol 45–115%		TestAmerica-St. Louis Analyst	Accuracy	4-Chloro-3-methyl phenol 45–115%
		4–Nitrophenol 15–140%		TestAmerica-St. Louis Analyst	Accuracy	4-Nitrophenol 15–140%
		Pentachlorophenol 25–120%		TestAmerica-St. Louis Analyst	Accuracy	Pentachlorophenol 25–120%
		Phenol 40–100%		TestAmerica-St. Louis Analyst	Accuracy	Phenol 40–100%

SAP Worksheet #28.1 – Laboratory QC Samples Table – Soil (Continued)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
LCS (cont.)		Pyrene 45–125%		TestAmerica-St. Louis Analyst	Accuracy	Pyrene 45–125%
MS/MSD	1 per preparatory batch per matrix	1,2,4–Trichlorobenzene 45–110%	c	TestAmerica-St. Louis Analyst	Accuracy/ Precision	1,2,4–Trichlorobenzene 45–110%
		1,4–Dichlorobenzene 35–105%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	1,4–Dichlorobenzene 35–105%
		2,4–Dinitrotoluene 50–115%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	2,4–Dinitrotoluene 50–115%
		Acenaphthene 45–110%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	Acenaphthene 45–110%
		2–Chlorophenol 45–105%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	2–Chlorophenol 45–105%
		n–Nitrosodi–n–propylamine 40–115%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	n–Nitrosodi–n–propylamine 40–115%
		4–Chloro–3–methyl phenol 45–115		TestAmerica-St. Louis Analyst	Accuracy/ Precision	4–Chloro–3–methyl phenol 45–115%
		4–Nitrophenol 15–140%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	4–Nitrophenol 15–140%
		Pentachlorophenol 25–120%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	Pentachlorophenol 25–120%
		Phenol 40–100%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	Phenol 40–100%
		Pyrene 45–125%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	Pyrene 45–125%

SAP Worksheet #28.1 – Laboratory QC Samples Table – Soil (Continued)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Surrogate	Per all field and QC samples	2,4,6–Tribromophenol 35–125%	d	TestAmerica-St. Louis Analyst	Accuracy	2,4,6–Tribromophenol 35–125%
		2–Fluorbiphenyl 45–105%		TestAmerica-St. Louis Analyst	Accuracy	2–Fluorbiphenyl 45–105%
		2–Fluorophenol 35–105%		TestAmerica-St. Louis Analyst	Accuracy	2–Fluorophenol 35–105%
		Nitrobenzene–d_5 35–100%		TestAmerica-St. Louis Analyst	Accuracy	Nitrobenzene–d_5 35–100%
		Phenol– d_5 40–100%		TestAmerica-St. Louis Analyst	Accuracy	Phenol– d_5 40–100%
		Terphenyl– d_{14} 30–125%		TestAmerica-St. Louis Analyst	Accuracy	Terphenyl– d_{14} 30–125%

SAP Worksheet #28.1 – Laboratory QC Samples Table – Soil (Continued)

Matrix: Soil
Analytical Group: Pesticides
Analytical Method/SOP Reference: EPA 8081B/SOP ST-GC-0016

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	a	TestAmerica-St. Louis Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	4,4′–DDT 45–140% Aldrin 45–140% Dieldrin 65–125% Endrin 60–135% Gamma–BHC (Lindane) 60–125% Heptachlor 50–140%	b	TestAmerica-St. Louis Analyst	Accuracy	4,4′–DDT 45–140% Aldrin 45–140% Dieldrin 65–125% Endrin 60–135% Gamma–BHC (Lindane) 60–125% Heptachlor 50–140%
MS/MSD	1 per preparatory batch per matrix	4,4′–DDT 45–140% Aldrin 45–140% Dieldrin 65–125% Endrin 60–135% Gamma–BHC (Lindane) 60–125% Heptachlor 50–140%	c	TestAmerica-St. Louis Analyst	Accuracy/ Precision	4,4′–DDT 45–140% Aldrin 45–140% Dieldrin 65–125% Endrin 60–135% Gamma–BHC (Lindane) 60–125% Heptachlor 50–140%
Surrogate	Per all field and QC samples	Decachlorobiphenyl 55–130% Tetrachloro–m–xylene(TCMX) 70–125%	d	TestAmerica-St. Louis Analyst	Accuracy	Decachlorobiphenyl 55–130% Tetrachloro–m–xylene (TCMX) 70–125%

SAP Worksheet #28.1 – Laboratory QC Samples Table – Soil (Continued)

Matrix: Soil
Analytical Group: PCBs
Analytical Method/SOP Reference: EPA 8082A/SOP ST-GC-0015

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	Aroclor 1016: 40–140% Aroclor 1260: 60–130%	[b]	TestAmerica-St. Louis Analyst	Accuracy	Aroclor 1016: 40–140% Aroclor 1260: 60–130%
MS/MSD	1 per preparatory batch per matrix	Aroclor 1016: 40–140% Aroclor 1260: 60–130% RPD ≤ 30	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	Aroclor 1016: 40–140% Aroclor 1260: 60–130% RPD ≤ 30
Surrogate	Per all field and QC samples	Decachlorobiphenyl 60–125%	[d]	TestAmerica-St. Louis Analyst	Accuracy	Decachlorobiphenyl 60–125%

SAP Worksheet #28.1 – Laboratory QC Samples Table – Soil (Continued)

Matrix: Soil
Analytical Group: TPH-purgeable
Analytical Method/SOP Reference: EPA 8015B/SOP ST-GC-0014

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	TPH-gasoline: 57–127%	[b]	TestAmerica-St. Louis Analyst	Accuracy	TPH-gasoline: 57–127%
MS/MSD	1 per preparatory batch per matrix	TPH-gasoline: 50–114% RPD ≤ 30	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	TPH-gasoline: 50–114% RPD ≤ 30
Surrogate	Per all field and QC samples	4-Bromofluorobenzene: 78–141%	[d]	TestAmerica-St. Louis Analyst	Accuracy	4-Bromofluorobenzene: 78–141%

SAP Worksheet #28.1 – Laboratory QC Samples Table – Soil (Continued)

Matrix: Soil
Analytical Group: TPH-extractable
Analytical Method/SOP Reference: EPA 8015B/SOP ST-GC-0005

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	TPH-diesel: 50–121%	[b]	TestAmerica-St. Louis Analyst	Accuracy	TPH-diesel: 50–121%
MS/MSD	1 per preparatory batch per matrix	TPH-diesel: 18–150% RPD ≤ 30	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	TPH-diesel: 18–150% RPD ≤ 30
Surrogate	Per all field and QC samples	o-terphenyl: 79–150%	[d]	TestAmerica-St. Louis Analyst	Accuracy	o-terphenyl: 79–150%

SAP Worksheet #28.1 – Laboratory QC Samples Table – Soil (Continued)

Matrix: Soil
Analytical Group: Metals
Analytical Method/SOP Reference: EPA 6020A and 7471B/SOP ST-MT-0001 and SOP ST-MT-0007

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < ½ QL
Calibration Blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence	No analytes detected > 2 × MDL	[a]	TestAmerica-St. Louis Analyst	Accuracy	No analytes detected > 2 × MDL
LCS	1 per preparatory batch	80–120%	[b]	TestAmerica-St. Louis Analyst	Accuracy	80–120%
MS/MSD (lab duplicate)	1 per preparatory batch per matrix	80–120% RPD ≤ 20	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	80–120% RPD ≤ 20
Serial dilution	Each new sample matrix	1:5 dilution must agree within ±10% of original determination.	[f]	TestAmerica-St. Louis Analyst	Accuracy	1:5 dilution must agree within ±10% of original determination.
Post-digestion spike	When serial dilution or matrix spike fails	75–125%	[g]	TestAmerica-St. Louis Analyst	Accuracy	75–125%

Notes:

[a] Any sample associated with a blank that fails the criteria checks will be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in a non-detect. If no sample volume remains for reprocessing, the results will be reported with appropriate data qualifying codes.

[b] Reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.

[c] The data will be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.

[d] Truncate carriers/tracers above 100% recovery to eliminate low biased results. Re-prep and reanalyze sample if carrier is low (indicating high biased results) if there is activity in the sample above the reporting limit. No reanalysis if matrix interference is nonconformance during sample preparation.

[e] Reprep and reanalyze the sample and duplicate in the associated preparatory batch for failed analytes if sufficient sample material is available and the sample is homogeneous. If RPD/RER still out of range, report as matrix interference confirmed and write a nonconformance. If reanalysis is in range, re-extract samples in batch.

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water

Matrix: Water
Analytical Group: Gamma Isotopes
Analytical Method/SOP Reference: Gamma/ RCHL-A-05 (on-site laboratory)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Background Sample	Daily	Absolute value less than analyte RL	[a]	NWT Laboratory Manager	Accuracy	Absolute value less than analyte RL
LCS	Weekly	Gamma source check +/- 20% of known activity	[b]	NWT Laboratory Manager	Accuracy	Gamma source check +/- 20% of known activity
Sample Duplicate	1 per preparatory batch and or every 20 samples	RPD $\leq$30	[d]	NWT Laboratory Manager	Precision	RPD $\leq$30

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: Strontium-90
Analytical Method/SOP Reference: EPA 905 MOD or DOE SR-03-RC MOD/SOP ST-RD-0403

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < RL
LCS and/or LCD	1 per preparatory batch	Within in-house limits	[b]	TestAmerica-St. Louis Analyst	Accuracy	EPA 905.0 MOD: 75–135% DOE SR-03-RC MOD: 75–135% RPD ≤40% and/or RER ≤1
MS/MSD	As requested	Within in-house limits	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	EPA 905.0 MOD: 33–150% DOE SR-03-RC MOD: 33–150% RPD ≤40% and/or RER ≤1
Carriers	Per sample, blank, LCS, MS, MSD	Sr and Yt carriers ≥40% and ≤110%	[d]	TestAmerica-St. Louis Analyst	Accuracy	Sr and Yt carriers ≥40% and ≤110%
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	[e]	TestAmerica-St. Louis Analyst	Accuracy	RPD ≤40% and/or RER ≤1

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: Gamma and Radium-226
Analytical Method/SOP Reference: EPA 901.1 MOD and 903.0 MOD/SOP ST-RD-0102 and SOP ST-RD-0403

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < RL
LCS and/or LCD	1 per preparatory batch	Within in-house limits	[b]	TestAmerica-St. Louis Analyst	Accuracy	72–130 % RPD ≤ 40% and/or RER ≤ 1
MS/MSD	As requested	Within in-house limits	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	50–130 % RPD ≤ 40% and/or RER ≤ 1
Carriers	Per sample, blank, LCS, MS, MSD	Ba and Yt carriers ≥40% and ≤110%	[d]	TestAmerica-St. Louis Analyst	Accuracy	Ba and Yt carriers ≥40% and ≤110%
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	[e]	TestAmerica-St. Louis Analyst	Accuracy	RPD ≤40% and/or RER ≤1

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: Isotopic Uranium
Analytical Method/SOP Reference: DOE A-01-R MOD/SOP ST-RD-0210

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	a	TestAmerica-St. Louis Analyst	Accuracy	Analytes < RL
LCS and/or LCD	1 per preparatory batch	Within in-house limits	b	TestAmerica-St. Louis Analyst	Accuracy	^{234}U: 87–127% ^{238}U: 87–128% RPD ≤40% and/or RER ≤1
MS/MSD	As requested	Within in-house limits	c	TestAmerica-St. Louis Analyst	Accuracy/ Precision	^{234}U: 65–146% ^{238}U: 68–143% RPD ≤40% and/or RER ≤1
Tracer	Per sample, blank, LCS, MS, MSD	Within in-house limits	d	TestAmerica-St. Louis Analyst	Accuracy	^{232}U: 30–110%
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	e	TestAmerica-St. Louis Analyst	Accuracy	RPD ≤40% and/or RER ≤1

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: Isotopic Thorium
Analytical Method/SOP Reference: DOE A-01-R MOD/SOP ST-RD-0210

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < RL
LCS and/or LCD	1 per preparatory batch	Within in-house limits	[b]	TestAmerica-St. Louis Analyst	Accuracy	^{230}Th: 92–138% RPD ≤40% and/or RER ≤1
MS/MSD	As requested	Within in-house limits	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	^{230}Th: 82–139% RPD ≤40% and/or RER ≤1
Tracer	Per sample, blank, LCS, MS, MSD	Within in-house limits	[d]	TestAmerica-St. Louis Analyst	Accuracy	^{229}Th: 30–110%
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	[e]	TestAmerica-St. Louis Analyst	Accuracy	RPD ≤40% and/or RER ≤1

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: Isotopic Plutonium
Analytical Method/SOP Reference: DOE A-01-R MOD/SOP ST-RD-0210

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < RL
LCS and/or LCD	1 per preparatory batch	Within in-house limits	[b]	TestAmerica-St. Louis Analyst	Accuracy	^{238}Pu: 80–110% ^{239}Pu/^{240}Pu: 84–115% RPD ≤40% and/or RER ≤1
MS/MSD	As requested	Within in-house limits	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	^{238}Pu: 70–130% ^{239}Pu/^{240}Pu: 70–130% RPD ≤40% and/or RER ≤1
Tracer	Per sample, blank, LCS, MS, MSD	Within in-house limits	[d]	TestAmerica-St. Louis Analyst	Accuracy	^{242}Pu: 30–110%
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	[e]	TestAmerica-St. Louis Analyst	Accuracy	RPD ≤40% and/or RER ≤1

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: Tritium
Analytical Method/SOP Reference: EPA 906.0 MOD/SOP ST-RD-0302

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < RL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < RL
LCS and/or LCD	1 per preparatory batch	Within in-house limits	[b]	TestAmerica-St. Louis Analyst	Accuracy	67–111% RPD ≤40% and/or RER ≤1
MS/MSD	As requested	Within in-house limits	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	27–150% RPD ≤40% and/or RER ≤1
Sample Duplicate	1 per preparatory batch	RPD ≤40% and/or RER ≤1	[e]	TestAmerica-St. Louis Analyst	Accuracy	RPD ≤40% and/or RER ≤1

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: VOCs
Analytical Method/SOP Reference: EPA 8260C/SOP ST-MS-0002

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	1,1-Dichloroethene: 70–130% Benzene: 80–120% Chlorobenzene 80–120% Toluene: 75–120% Trichloroethene: 70–125%	[b]	TestAmerica-St. Louis Analyst	Accuracy	1,1-Dichloroethene: 70–130% Benzene: 80–120% Chlorobenzene 80–120% Toluene: 75–120% Trichloroethene: 70–125%
MS/MSD	1 per preparatory batch per matrix	1,1-Dichloroethene: 70–130% Benzene: 80–120% Chlorobenzene 80–120% Toluene: 75–120% Trichloroethene: 70–125%RPD ≤ 20	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	1,1-Dichloroethene: 70–130% Benzene: 80–120% Chlorobenzene 80–120% Toluene: 75–120% Trichloroethene: 70–125%RPD ≤ 20
Surrogate	Per all field and QC samples	1,2-Dichloroethane-d_4: 70–120% 4-Bromofluorobenzene: 75–120% Toluene-d_8: 85–120%	[d]	TestAmerica-St. Louis Analyst	Accuracy	1,2-Dichloroethane-d_4: 70–120% 4-Bromofluorobenzene: 75–120% Toluene-d_8: 85–120%

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: SVOCs
Analytical Method/SOP Reference: EPA 8270D/ SOP ST-MS-0001

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	1,2,4-Trichlorobenzene 35–105%	[b]	TestAmerica-St. Louis Analyst	Accuracy	1,2,4-Trichlorobenzene 35–105%
		1,4-Dichlorobenzene 30–100%		TestAmerica-St. Louis Analyst	Accuracy	1,4-Dichlorobenzene 30–100%
		2,4-Dinitrotoluene 50–120%		TestAmerica-St. Louis Analyst	Accuracy	2,4-Dinitrotoluene 50–120%
		Acenaphthene 45–110%		TestAmerica-St. Louis Analyst	Accuracy	Acenaphthene 45–110%
		2-Chlorophenol 35–105%		TestAmerica-St. Louis Analyst	Accuracy	2-Chlorophenol 35–105%
		n-Nitrosodi-n-propylamine 35–130%		TestAmerica-St. Louis Analyst	Accuracy	n-Nitrosodi-n-propylamine 35–130%
		4-Chloro-3-methyl phenol 45–110%		TestAmerica-St. Louis Analyst	Accuracy	4-Chloro-3-methyl phenol 45–110%
		4-Nitrophenol 0–125%		TestAmerica-St. Louis Analyst	Accuracy	4-Nitrophenol 0–125%
		Pentachlorophenol 40–115%		TestAmerica-St. Louis Analyst	Accuracy	Pentachlorophenol 40–115%
		Phenol 0–115%		TestAmerica-St. Louis Analyst	Accuracy	Phenol 0–115%

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
LCS (cont.)		Pyrene 50–130%		TestAmerica-St. Louis Analyst	Accuracy	Pyrene 50–130%
MS/MSD	1 per preparatory batch per matrix	1,2,4-Trichlorobenzene 35–105%	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	1,2,4-Trichlorobenzene 35–105%
		1,4-Dichlorobenzene 30–100%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	1,4-Dichlorobenzene 30–100%
		2,4-Dinitrotoluene 50–120%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	2,4-Dinitrotoluene 50–120%
		Acenaphthene 45–110%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	Acenaphthene 45–110%
		2-Chlorophenol 35–105%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	2-Chlorophenol 35–105%
		n-Nitrosodi-n-propylamine 35–130%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	n-Nitrosodi-n-propylamine 35–130%
		4-Chloro-3-methyl phenol 45–110%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	4-Chloro-3-methyl phenol 45–110%
		4-Nitrophenol 0–125%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	4-Nitrophenol 0–125%
		Pentachlorophenol 40–115%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	Pentachlorophenol 40–115%
		Phenol 0–115%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	Phenol 0–115%
		Pyrene 50–130%		TestAmerica-St. Louis Analyst	Accuracy/ Precision	Pyrene 50–130%
Surrogate	Per all field and QC samples	2,4,6-Tribromophenol 40–125%	[d]	TestAmerica-St. Louis Analyst	Accuracy	2,4,6-Tribromophenol 40–125%

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Surrogate (cont.)		2-Fluorbiphenyl 50–110%		TestAmerica-St. Louis Analyst	Accuracy	2-Fluorbiphenyl 50–110%
		2-Fluorophenol 20–110%		TestAmerica-St. Louis Analyst	Accuracy	2-Fluorophenol 20–110%
		Nitrobenzene-d_5 40–110%		TestAmerica-St. Louis Analyst	Accuracy	Nitrobenzene-d_5 40–110%
		Phenol- d_5 10–59%		TestAmerica-St. Louis Analyst	Accuracy	Phenol- d_5 10–59%
		Terphenyl- d_{14} 50–135%		TestAmerica-St. Louis Analyst	Accuracy	Terphenyl- d_{14} 50–135%

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: Pesticides
Analytical Method/SOP Reference: EPA 8081B/SOP ST-GC-0016

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	4,4′-DDT 45–140% Aldrin 25–140% Dieldrin 60–130% Endrin 55–135% Gamma-BHC (Lindane) 25–135% Heptachlor 40–130%	[b]	TestAmerica-St. Louis Analyst	Accuracy	4,4'-DDT 45–140% Aldrin 25–140% Dieldrin 60–130% Endrin 55–135% Gamma-BHC (Lindane) 25–135% Heptachlor 40–130%
MS/MSD	1 per preparatory batch per matrix	4,4′-DDT 45–140% Aldrin 25–140% Dieldrin 60–130% Endrin 55–135% Gamma-BHC (Lindane) 25–135% Heptachlor 40–130%	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	4,4'-DDT 45–140% Aldrin 25–140% Dieldrin 60–130% Endrin 55–135% Gamma-BHC (Lindane) 25–135% Heptachlor 40–130%
Surrogate	Per all field and QC samples	Decachlorobiphenyl 30–135% Tetrachloro-m-xylene (TCMX) 25–140%	[d]	TestAmerica-St. Louis Analyst	Accuracy	Decachlorobiphenyl 30–135% Tetrachloro-m-xylene (TCMX) 25–140%

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: PCBs
Analytical Method/SOP Reference: EPA 8082A/SOP ST-GC-0015

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	Aroclor 1016: 25–145% Aroclor 1260: 30–145%	[b]	TestAmerica-St. Louis Analyst	Accuracy	Aroclor 1016: 25–145% Aroclor 1260: 30–145%
MS/MSD	1 per preparatory batch per matrix	Aroclor 1016: 25–145% Aroclor 1260: 30–145%RPD ≤ 20	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	Aroclor 1016: 25–145% Aroclor 1260: 30–145%RPD ≤ 20
Surrogate	Per all field and QC samples	Decachlorobiphenyl: 40–135%	[d]	TestAmerica-St. Louis Analyst	Accuracy	Decachlorobiphenyl: 40–135%

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: TPH-purgeable
Analytical Method/SOP Reference: EPA 8015B/SOP ST-GC-0014

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	TPH-gasoline: 74–111%	[b]	TestAmerica-St. Louis Analyst	Accuracy	TPH-gasoline: 74–111%
MS/MSD	1 per preparatory batch per matrix	TPH-gasoline: 74–115% RPD ≤ 20	[c]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	TPH-gasoline: 74–115% RPD ≤ 20
Surrogate	Per all field and QC samples	4-Bromofluorobenzene: 55–150%	[d]	TestAmerica-St. Louis Analyst	Accuracy	4-Bromofluorobenzene: 55–150%

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: TPH-extractable
Analytical Method/SOP Reference: EPA 8015B/SOP ST-GC-0005

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	a	TestAmerica-St. Louis Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	TPH-diesel: 44–103%	b	TestAmerica-St. Louis Analyst	Accuracy	TPH-diesel: 70–140%
MS/MSD	1 per preparatory batch per matrix	TPH-diesel: 60–140% RPD ≤ 30	c	TestAmerica-St. Louis Analyst	Accuracy/ Precision	TPH-diesel: 60–140% RPD ≤ 30
Surrogate	Per all field and QC samples	Bromobenzene: 50–130% Hexacosane: 70–140%	d	TestAmerica-St. Louis Analyst	Accuracy	Bromobenzene: 50–130% Hexacosane: 70–140%

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: Metals
Analytical Method/SOP Reference: EPA 6020A and 7470A/SOP ST-MT-0001 and SOP ST-MT-0005

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	TestAmerica-St. Louis Analyst	Accuracy	Analytes < ½ QL
Calibration Blank	Before beginning a sample run, after every 10 samples, and at end of the analysis sequence	No analytes detected > 2 × MDL	[a]	TestAmerica-St. Louis Analyst	Accuracy	No analytes detected > 2 × MDL
LCS	1 per preparatory batch	80–120%	[b]	TestAmerica-St. Louis Analyst	Accuracy	80–120%
MS/MSD (lab duplicate)	1 per preparatory batch per matrix	80–120% RPD ≤ 20	[d]	TestAmerica-St. Louis Analyst	Accuracy/ Precision	80–120% RPD ≤ 20
Serial dilutions	Each new sample matrix	1:5 dilution must agree within ±10% of original determination.	[f]	TestAmerica-St. Louis Analyst	Accuracy	1:5 dilution must agree within ±10% of original determination.
Post-digestion spike	When serial dilution or matrix spike fails	75–125%	[g]	TestAmerica-St. Louis Analyst	Accuracy	75–125%

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: Herbicides
Analytical Method/SOP Reference: EPA 8151A/SOP GC-0017

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	Dalapon 40–110%	[b]	Analyst	Accuracy	Dalapon 40–110%
MS/MSD	1 per preparatory batch per matrix	Dalapon 40–110% RPD ≤ 20%	[c]	Analyst	Accuracy/ Precision	Dalapon 40–110% RPD ≤ 20%

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: Oil and Grease
Analytical Method/SOP Reference: EPA 1664/SOP ST-WC-0039

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	Oil and Grease 78–114%	[b]	Analyst	Accuracy	Oil and Grease 78–114%
MS/MSD	1 per preparatory batch per matrix	Oil and Grease 78–114% RPD $\leq$ 20%	[c]	Analyst	Accuracy/ Precision	Oil and Grease 78–114% RPD $\leq$ 20%

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: TRPH
Analytical Method/SOP Reference: EPA 1664/SOP ST-WC-0039

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	TRPH 64–132%	[b]	Analyst	Accuracy	TRPH 64–132%
MS/MSD	1 per preparatory batch per matrix	TRPH 64–132% RPD ≤ 20%	[c]	Analyst	Accuracy/ Precision	TRPH 64–132% RPD ≤ 20%

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: TSS
Analytical Method/SOP Reference: EPA 160.1/SOP ST-WC-0036

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	67–130%	[b]	Analyst	Accuracy	67–130%
MS/MSD	1 per preparatory batch per matrix	N/A	[c]	Analyst	Accuracy/ Precision	N/A

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: pH
Analytical Method/SOP Reference: EPA 150.1/SOP ST-WC-001

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	99–101%	[b]	Analyst	Accuracy	99–101%
MS/MSD	1 per preparatory batch per matrix	N/A	[c]	Analyst	Accuracy/ Precision	N/A

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: Ignitability
Analytical Method/SOP Reference: EPA 1010/SOP ST-WC-0026

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	95.9 – 104 deg C	[b]	Analyst	Accuracy	95.9 – 104 deg C
MS/MSD	1 per preparatory batch per matrix	N/A	[c]	Analyst	Accuracy/ Precision	N/A

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: COD
Analytical Method/SOP Reference: EPA 410.4/SOP ST-WC-0004

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	90–110%	[b]	Analyst	Accuracy	90–110%
MS/MSD	1 per preparatory batch per matrix	90–110% RPD ≤ 20%	[c]	Analyst	Accuracy/ Precision	90–110% RPD ≤ 20%

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: Total/Dissolved Sulfide
Analytical Method/SOP Reference: EPA 376.1/SOP ST-WC-0012

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	a	Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	90–110%	b	Analyst	Accuracy	90–110%
MS/MSD	1 per preparatory batch per matrix	90–110% RPD ≤ 20%	c	Analyst	Accuracy/ Precision	90–110% RPD ≤ 20%

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: Cyanide
Analytical Method/SOP Reference: EPA 335.4/SOP ST-WC-0002

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	85–115%	[b]	Analyst	Accuracy	85–115%
MS/MSD	1 per preparatory batch per matrix	66–120% RPD ≤ 20%	[c]	Analyst	Accuracy/ Precision	66–120% RPD ≤ 20%

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Matrix: Water
Analytical Group: Phenols
Analytical Method/SOP Reference: EPA 420.1/SOP ST-WC-0017

QC Sample	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1 per preparatory batch	Analytes < ½ QL	[a]	Analyst	Accuracy	Analytes < ½ QL
LCS	1 per preparatory batch	79–113%	[b]	Analyst	Accuracy	79–113%
MS/MSD	1 per preparatory batch per matrix	54–131% RPD ≤ 20%	[c]	Analyst	Accuracy/ Precision	54–131% RPD ≤ 20%

SAP Worksheet #28.2 – Laboratory QC Samples Table – Water (Continued)

Notes:

[a] Any sample associated with a blank that fails the criteria checks will be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in a non-detect. If no sample volume remains for reprocessing, the results will be reported with appropriate data qualifying codes.

[b] Reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.

[c] The data will be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error. Perform post-digestion spike addition if matrix spike does not meet criteria.

[d] Reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available.

[e] Inspect mass spectrometer and gas chromatograph for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.

[f] Perform post-digestion spike addition if serial dilution does not meet criteria.

[g] Reanalyze post-digestion spike.

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SAP Worksheet #29 – Project Documents and Records Table

Document	Where Maintained
Field logbook	Project file
Field forms	Project file
COC	Laboratory; NAVFAC SW Administrative Record will receive original copy
Shipping records	Project file
Field surveillance reports	Project file
Field Change Requests	Project file
Daily on-site laboratory results package including: • Copy of chain of custody • Sample results • Control check standard per batch • Laboratory duplicate results • Laboratory signed review page	Laboratory and project file; project file copy will subsequently be sent to NAVFAC SW Administrative Record
On-site laboratory data package for 10 percent of field status survey samples sent to off-site laboratory for QA analysis: • Copy of chain of custody • Instrument calibration information • Sample results • Control check standard per batch • Laboratory duplicate results • Associated raw data spectral analysis per sample • Laboratory signed review page	Laboratory and project file; project file copy will subsequently be sent to NAVFAC SW Administrative Record
Off-site laboratory data package including: • Copy of chain of custody • Sample receipt and login • Laboratory internal chain of custody • Instrument calibration information • Sample preparation logs • Sample analysis/run logs • Nonconformance Reports including corrective actions • Laboratory signed review page	Laboratory and project file; project file copy will subsequently be sent to NAVFAC SW Administrative Record
Data validation report	Validator and project file; project file copy will subsequently be sent to NAVFAC SW Administrative Record

SAP Worksheet #29 – Project Documents and Records Table (Continued)

Field documentation associated with sampling activities includes logbooks, sample labels, COCs, sample shipping records, field surveillance reports, and Field Change Request (FCR) forms. In addition, laboratory and validator documentation will be generated during this project. These types are described in the following sections.

Field Logbook

A permanently bound field logbook with consecutively numbered pages, used for sampling activities only, will be assigned to this project. All entries will be recorded in indelible black or blue ink. At the end of each work day, the logbook pages will be signed by the responsible sampler, and any unused portions of the logbook pages will be crossed out, signed, and dated. If it is necessary to transfer the logbook to another person, the person relinquishing the logbook will sign and date the last page used, and the person receiving the logbook will sign and date the next page to be used. At a minimum, the logbook will contain the following information:

- Project name and site location
- Date and time
- Personnel in attendance
- General weather information
- Work performed
- Field observations
- Sampling performed, including specifics such as location, type of sample, type of analyses, and sample identification
- Field analyses performed, including results, instrument checks, problems, and calibration records for field instruments
- Descriptions of deviations from this SAP
- Problems encountered and corrective action taken
- Identification of field QC samples
- QC activities
- Verbal or written instructions
- Any other events that may affect the samples

Sample Labels

Sample labels typically will be computer-generated at the time the COC is prepared and produced by the approved TtEC COC database program. Sample labels will be filled out in indelible black or blue ink and affixed to sample containers at the time of sample collection. An

SAP Worksheet #29 – Project Documents and Records Table (Continued)

example sample label is provided in Attachment 1. Each sample label will be covered with clear tape. Each sample container will be labeled with the following, at a minimum:

- Sample identification number
- Sample collection date (month/day/year)
- Time of collection (24-hour clock) from the start of sampling
- Sampler's initials
- Preservative (if any)
- Sample weight (data completed by laboratory)

When a plastic bag is used to collect samples (i.e., sediment) for radiological analysis, then the sample bag will be directly marked with indelible ink. If this sample is then transferred to a container, the lid of the container will be labeled. If containers are too small to fit all of the above-listed sample information, at a minimum the container will be labeled with the designation of the consecutive sample number.

Chain-of-Custody

COC information is described in Worksheet #27.

Sample Shipping Records

Samples will be transported to the laboratory via courier or FedEx. The courier who receives samples will sign the COC and accept the samples. For samples shipped via FedEx, the COC will be packaged within the cooler, and the sender's copy of the airbill will serve as custody documentation and will be maintained on-site in the project file. Sample shipping procedures are detailed in Worksheet #27.

Field Surveillance Reports

Field Surveillances will be performed in accordance with the three phases of inspection as required by the Remedial Action Contract QC Program. A Preparatory Inspection will be performed by the PQCM prior to the first sampling activities. This will include a general orientation for health and safety. An Initial Inspection will be conducted at the beginning of field sampling activities for project. Daily field inspections and subsequent surveillances will be performed at the discretion of the PQCM or the Quality Control Program Manager throughout the duration of the project. The PQCM will use the Initial Inspection Checklist during inspection.

SAP Worksheet #29 – Project Documents and Records Table (Continued)

Field Change Request

An FCR will be prepared by the Project Chemist, or a designee, if a change to the SAP occurs during sampling activities. These changes will be minor and not result in a change in scope and/or DQOs for this project. The FCR must be approved prior to field implementation. The FCR will include the revised worksheets from this SAP. Examples of worksheets that may be revised due to minor changes such as personnel changes would be Worksheets #3 (Distribution List), #4 (Project Personnel Sign-Off Sheet), #5 (Project Organizational Chart), #6 (Communication Pathways), and #7 (Personnel Responsibilities and Qualifications Table).

Major changes to work scope affecting the original DQOs or meeting criteria described in EWI #2, 3EVR.2, Review, Approval, Revision, and Amendment of Sampling and Analysis Plans (SAPs) (NAVFAC SW 2006) will require preparation of a SAP Addendum. The SAP Addendum must be approved by the Naval Facilities Engineering Command Southwest (NAVFAC SW) Quality Assurance Officer (QAO) prior to conducting sampling and analysis.

Laboratory Documentation

Laboratory records associated with project samples analyzed include the following at a minimum:

- Sample receipt and login
- Laboratory internal COC
- Instrument calibration logs
- Sample preparation logs
- Sample analysis/run logs
- Sample results case narrative
- Sample disposal records
- Nonconformance reports including corrective actions

The laboratory will prepare analytical data packages comprising the above documentation for each sample delivery group (SDG) and provide them to TtEC. Laboratory deliverables will include two copies of the hard copy data package, submitted as either EPA Level III- or IV-equivalent packages as specified on the COC. Detailed information on the requirement of hard copy data packages is provided below. The report pages will be sequentially numbered. The report will contain a table of contents referencing individual sections in the data package, the original, white copy of COC records, a copy of all corrective action reports, and a narrative documenting the resolution of all corrective actions and nonconformances. All samples will be cross-referenced to the associated QC samples. The packages will be assembled in the following sequence:

SAP Worksheet #29 – Project Documents and Records Table (Continued)

- Cover page (with laboratory name, address, phone number, contact person, and SDG number, as well as the project name and project number)
- Table of contents
- Case narrative
- Sample management records, including the original, white copy of COC records (including cooler temperature and sample condition), shipping documents, and laboratory sample receipt forms
- Cross-reference table
- Analytical results and QA/QC information by test as follows:
  - Radiological raw data sequence
    a. Sample results forms, including method blanks
    b. Sample raw data (EPA Level IV only)
    c. QC summaries
    d. Initial calibration (ICAL)
    e. Calibration checks, including all related continuing calibration verifications (CCVs)
    f. Instrument run log
    g. Sample preparation log
  - Organic raw data sequence
    a. Sample result forms, including method blanks
    b. Sample raw data after each result form (EPA Level IV only)
    c. Surrogate summaries (surrogate results may appear on the sample result forms)
    d. QC summaries
    e. Tune data (gas chromatograph/mass spectrometer [GC/MS] only)
    f. ICAL
    g. Daily calibration checks, including related CCVs
    h. Resolution check standards (GC/MS and pesticides), if applicable
    i. QC LCS, MS/MSD raw data (EPA Level IV only)
    j. Instrument run log
    k. Sample preparation log
  - Inorganic raw data sequence
    a. Sample results forms, including method blanks
    b. Sample raw data (EPA Level IV only)
    c. QC summaries
    d. ICAL

SAP Worksheet #29 – Project Documents and Records Table (Continued)

e. Daily calibration checks, including all related CCVs
f. Calibration blanks, including all related continuing calibration blanks
g. Interference check standards A and B for inductively coupled plasma (ICP)-atomic emission spectrometer (AES) only
h. QC raw data (EPA Level IV only)
i. Post-digestion spike results
j. Analytical spike results
k. Method of standard additions
l. ICP-AES serial dilutions
m. Instrument run log
n. Sample preparation log

All relevant laboratory raw data and documentation including, but not limited to, logbook, data sheets, electronic files, and reports, will be maintained by the laboratory for at least 5 years. TtEC must be notified 30 days before disposal of any relevant records.

In addition to the hard copy data, an EDD will be submitted in American Standard Code for Information Interchange format. Both the EDDs and the hard copy report will present results to two or three significant figures. For radiological results, at least three significant figures will be used for all results. For organic results, two significant figures will be used for all results. For inorganic results, two significant figures will be used for results less than 10, and three significant figures will be used for results greater than 10. Results for QC analyses (method blanks, MS/MSD, LCS, and duplicates) will be reported up to three significant figures.

When revisions to data reports are required, the revised pages (an original and copy) will be stamped with the notation "amended or revised report." If revisions affect the EDDs, the revised EDD will then be sent along with the revised hard copy pages. In addition, a hard copy or electronic copy of items submitted to the validator by the laboratory will also be submitted to the Project Chemist.

Data Validation Reports

All analytical data generated from laboratories except waste characterization data will be validated by an independent data validation company. The validation report will include the data validation findings worksheets. The reports will be arranged in increasing SDG numbers and grouped by the type of analysis; i.e., a group of reports will consist of SDGs with the same analysis arranged in increasing numerical order. Each SDG will be submitted as a separate data validation report. Reports covering multiple SDGs are not acceptable.

SAP Worksheet #29 – Project Documents and Records Table (Continued)

The validation reports will contain the following information:

- Title page that contains project name, sample collection date, validator subcontractor name, report date, type of analysis, laboratory, SDG, sample identifications (including MS/MSD, duplicate, reanalysis, or dilution samples), sample matrix (e.g., soil, water), and validation level (EPA Level III or IV)
- Introduction page that includes the number of samples per matrix, analytical method reference, validation guideline reference, and section references to summary qualification flags, and denotes QC samples. Statements regarding flag classification (protocol/ advisory) and whether raw data check was performed will also be included.
- Section headings for each analytical method will include the following:
  - Technical holding times
  - GC/MS instrument performance check (tune) if applicable
  - Calibration
    a. ICAL
    b. Initial calibration verification (second source standard)
    c. CCV
  - Laboratory blanks
  - Accuracy and precision data
    a. Surrogate spike recoveries
    b. MS/MSD
    c. LCSs/LCS duplicates (LCSDs)
    d. Internal standards
  - Target compound identification
  - System performance checks
  - Analyte quantitation and quantitation limit (QLs)
  - Field QC samples (if not applicable, report will note)
  - Overall assessment of data
  - Assessment of compliance with statement of work requirements
- QC deviation summaries, which will include in a tabular format the following:
  - Unique identification of QC run (e.g., date/time)
  - Associated project and sample numbers (not the laboratory internal sample IDs)
  - Associated constituents
  - Actual value for noted deviation
  - Applicable QC criteria
  - Applicable qualifiers
  - Qualifier classifications (advisory or protocol)

SAP Worksheet #29 – Project Documents and Records Table (Continued)

- Validation findings worksheets
- Qualifier classification

The following format will be used when preparing and submitting revised data validation reports and analytical result pages:

- The cover letter and revised text pages will clearly identify the revision number (e.g., **Revision 1**) typed in the upper right-hand corner of the page.
- A statement in the cover letter will be included indicating that an asterisk will be placed in the margin to the left of any revised item in the text.
- Every revised page in the text will have the following statement placed at the bottom of the page:

  ***Indicates revision based on report review.**

- The summary table will have an asterisk placed to the left of every revised item and a statement at the bottom of the page as follows:

  ***Indicates change as a result of report review.**

Revisions will be submitted within 1 week of receiving the review comments from the Project Chemist. Report revision submittal packages will include an original and copy of the cover page and revised pages.

In addition to a hard-copy report, the validator will receive the EDD and populate the final validation qualifiers in the EDD. The validated EDD will be returned to TtEC for upload into the database.

The data validation subcontractor will maintain validation records for at least 5 years. TtEC will be notified 30 days before disposal of any records.

SAP Worksheet #30 – Analytical Services Table

Matrix	Analytical Group	Sampling Locations/ ID Number	Analytical Method	Data Package Turnaround Time	Laboratory/ Organization (contact information)	Backup Laboratory/ Organization (contact information)
All	All	All	All	20 business days	TestAmerica Laboratories, Inc. St. Louis Contact: Ivan Vania 13715 Rider Trail North Earth City, MO 63045 (314) 298-8566	GEL Contact: Tasha Horton 2040 Savage Road Charleston, SC 29407 (843) 556-8171

Off-Site Laboratory Quality Objectives

The following sections describe analytical laboratory requirements, including qualifications, sample custody, and QC procedures.

Off-Site Laboratory Qualifications

The analytical laboratories selected to analyze samples for this project will be, at a minimum, certified by the California Department of Health Services (DHS) (or the California Department of Public Health [CDPH]) for all of the analytical methods required for the project, as applicable[1]. Additional state certifications may also be required for off-site radiological testing as required by the disposal facility. In addition, the laboratory must successfully complete the Naval Facilities Engineering Service Center (NFESC) Laboratory Evaluation Program or must be Department of Defense Environmental Laboratory Accreditation Program certified prior to sampling activities and maintain current status throughout the duration of the project.

The laboratory selected for the project must be capable of providing the project QC and data deliverables required by this SAP.

[1] DHS (or CDPH) does not provide for certification for soil or sediment radiochemical analysis. Therefore, no specific certification is required by either the on-site or off-site laboratories.

SAP Worksheet #30 – Analytical Services Table (Continued)

Laboratories, once selected, must be capable of meeting all the requirements listed in this SAP including turnaround time (to be determined), MDA requirements or QLs, QC criteria, data deliverables, and requirements in the Navy Installation Restoration Chemical Data Quality Manual (IRCDQM) (NFESC 1999), and the QSM for Environmental Laboratories (DoD 2006).

Off-Site Laboratory Sample Custody and Documentation

The integrity and traceability of samples from the time they are collected through the time data are reported are essential in any sampling and analysis program. The handling of the samples and transferring of custody must be well-documented given the evidentiary nature of the analytical data. A sample is considered to be in one's custody if it meets any of the following criteria:

1. In actual possession or in view of the person who collected the sample
2. Locked in a secure area
3. Placed in an area restricted to authorized personnel

The samples will be delivered to the person in the laboratory authorized to receive samples (referred to as the sample custodian). Upon receipt of a sample, the sample custodian will inspect the condition of the sample (including the temperature of the cooler as applicable) and the custody seal, reconcile the information on the sample label against that on the COC record, assign a unique laboratory tracking number, log the sample in the laboratory logbook, and store the sample in a secured sample storage room.

The TtEC Project Chemist will be informed immediately of any inconsistencies between the COC record and the sample containers received. Any deviations from accepted sample handling procedures will be documented, and the TtEC Project Chemist will be informed.

The laboratory will have a system for tracking samples that is consistent with Section 5.8 of the QSM (DoD 2006). The laboratory will archive the samples and maintain their custody up to 90 calendar days after sample collection, at which time the laboratory will contact TtEC for disposition.

SAP Worksheet #30 – Analytical Services Table (Continued)

Off-Site Laboratory Quality Control Requirements

The analytical laboratory will have written SOPs defining the instrument operation and maintenance, tuning, calibration, method detection limit (MDL) determination, QC acceptance criteria, blank requirements, and stepwise procedures for each analytical method. At a minimum, SOPs will be written for procedures and methods including sample receipt/control/disposal, sample preparation/extraction, sample analysis, result calculation, database management, health and safety, and corrective action. The SOPs, and all revisions, will be available to the analysts in the laboratory. The SOPs must meet the requirements of the analytical methods, the IRCDQM (NFESC 1999), and the QSM (DoD 2006), which defines the frequency, acceptance criteria, and corrective action for the following QC checks for each project-specific method:

Radioactive isotopes (EPA Methods 901.1 MOD for soil and 903.0 for water):

- Demonstrate acceptable analyst capability
- Initial calibration
- Second source calibration verification
- Calibration verification (initial and continuing calibration)
- Method blank
- LCS
- Background checks, efficiency checks, self-absorption curves as applicable

Organics by GC/MS (EPA Methods 8260C and 8270D):

- Demonstrate acceptable analyst capability
- MDL study
- Tuning
- Minimum five-point initial calibration
- Second source calibration verification

SAP Worksheet #30 – Analytical Services Table (Continued)

- Retention time window position establishment for each analyte and surrogate
- Retention time window verification for each analyte and surrogate
- Evaluation of relative retention times
- Calibration verification (initial and continuing calibration)
- Internal standards verification
- Method blank
- LCS
- MS/MSD
- Surrogate spike

Organics by Gas Chromatograph (GC) (EPA Methods 8081B, 8082A):

- Demonstrate acceptable analyst capability
- MDL study
- Retention time window width calculated for each analyte and surrogate
- Breakdown check (8081A only)
- Minimum five-point initial calibration
- Second source calibration verification
- Retention time window position establishment for each analyte and surrogate
- Retention time window verification for each analyte and surrogate
- Calibration verification (initial and continuing calibration)
- Method blank
- LCS
- MS/MSD

SAP Worksheet #30 – Analytical Services Table (Continued)

- Surrogate spike
- Confirmation of positive results by second column (8081A only)

Inorganics (EPA Methods 6020A/7000/413.1/160.1/150.1/1010/410.4/376.1/335.4/420.1):

- Demonstrate acceptable analyst capability
- MDL study
- Instrument detection limit study (ICP only)
- Initial calibration for all analytes (minimum one high standard and calibration blank for and minimum five standards and calibration blank for cold vapor atomic absorption)
- Second source calibration verification (ICP only)
- Continuing calibration verifications
- Low-level calibration check standard (ICP only)
- Method blank
- Calibration blank
- Interference check solutions (ICP only)
- LCS
- Dilution test (ICP only)
- Post-digestion spike addition (ICP only)
- Method of standard additions or internal standard calibration (ICP only)
- MS/MSD (MSD for ICP only)

The laboratory must also maintain written records of all activities that have an impact on the quality of the laboratory results.

SAP Worksheet #30 – Analytical Services Table (Continued)

Any portion of the method subcontracted by the laboratory to another laboratory or sent to another facility of the same network of laboratories must have the prior approval of the Project Chemist or PRSO.

Off-Site Laboratory Quality Control Checks

The following subsections describe in detail the laboratory QC checks required by this project.

Calibration

All instruments will be calibrated and the calibration acceptance criteria met before samples are analyzed. Calibration standards will be prepared with National Institute for Standards and Testing (NIST)-traceable standards and analyzed per method requirements. ICAL acceptance criteria documented in the laboratory SOPs will meet those of applicable guidance documents. The ICAL will meet the following requirements:

- The lowest concentration of the calibration standard is less than or equal to the QLs based on the final volume of extract or sample (except for gamma spectroscopy and radiochemical analysis at the on-site laboratory).
- For radiochemical analysis at the on-site laboratory, secondary and tertiary standards may be used provided the primary standard was NIST-traceable, and the expiration date of the secondary/tertiary standard does not exceed that of the primary standard. Radiochemcial standards used for MS/MD may be approximately 10 times the QL to provide for sufficient accumulation of data in a short period, provided that the final result plus the 2-sigma counting uncertainty does not exceed the QL, and the MDA indicated is less than the applicable QL.
- For gamma spectroscopy analysis, the calibration standard covers a wide array of energies, and the total sample activity contains approximately 1 microcurie of activity. The gamma spectroscopy standard will be of similar density and material to the samples being analyzed by this method. The typical calibration standard for gamma spectroscopy will utilize short-lived radionuclides that decay in as few as 90 days—therefore the standard will only be used for control checks and calibration for 1 year from date of certification.
- For each target analyte, at least one of the calibration standards will be at or below the regulatory limit (action level) (except as modified above), as defined by the DQOs.

SAP Worksheet #30 – Analytical Services Table (Continued)

- Before samples are analyzed, ICAL will be verified with a second source standard prepared at the mid-point of the calibration curve. ICAL verification will meet the acceptance criteria expressed in the laboratory SOPs.
- Daily calibration verification will be conducted at the method-prescribed frequencies and will meet the acceptance criteria of applicable guidance documents. Daily calibration verification will not be used for quantitation of target analytes.
- Calibration data (calibration tables, chromatograms, instrument printouts, and laboratory logbooks) will be clearly labeled to identify the source and preparation of the calibration standard and therefore be traceable to the standard preparation records.

Instrument Blanks

An instrument blank is used to monitor the cleanliness of the instrument system during sample analysis. Instrument blanks are solvent or acid solutions of the standard used to calibrate the instrument. During metals analyses, one instrument blank is usually analyzed for every ten samples. For GC/MS analysis, instrument blanks are analyzed on an as-needed basis for troubleshooting and chromatography column carryover determination.

Method Blanks

Method blanks are prepared in the same manner as the samples, using the same reagents and glassware used for samples. The purpose of the method blank is to ensure that the equipment and reagents used in preparing the samples are free of contaminants that could interfere with the analysis. The method blank must be prepared and analyzed for each batch of 20 project samples or less per matrix (aqueous and solid) type.

The method blank must not exhibit analytes at concentrations greater than half the required MDA or QLs. If contaminants are found that either contribute to the apparent concentration of a particular target analyte or interfere with the analysis, the analysis must be stopped, the source of contamination identified and corrected, and the analysis repeated. Contamination in the method blank above half the MDA or QLs will require that the entire associated batch of extracts or digestates be reprepared and reanalyzed. Hence, it is very important to make sure that no such contamination is present.

SAP Worksheet #30 – Analytical Services Table (Continued)

Some methods of inorganic analysis do not have a distinctive preparation step. For these tests, an instrument blank, which contains all reagents used with samples, is considered to be the method blank.

Off-site Laboratory Control Samples

Laboratory control samples are matrix-equivalent QC check samples (analyte-free water, laboratory sand, or sodium sulfate) spiked with a known quantity of specific analytes carried through the entire sample preparation and analysis process. The spiking solution used for LCS/LCSD preparation is of a source different from the stock used to prepare calibration standards.

The LCS is prepared and run at a frequency of one per 20 project samples per matrix with the associated samples, using the same reagents and volumes. If insufficient quantity of sample is available for the MS/MSD, the LCS will be prepared and analyzed in duplicates.

Off-site Laboratory Duplicates

For laboratory sample duplicate analyses, a sample is prepared and analyzed twice. Laboratory sample duplicates are prepared and analyzed with each batch of samples for most inorganic analyses. For this project, a laboratory duplicate will be prepared and analyzed for the on-site and off-site laboratory for each batch of samples. A batch for the off-site laboratory is defined as 20 samples or less.

Off-site Matrix Spikes

MSs are QC check samples that measure matrix-specific method performance for chemical analysis not to include radiological analysis. An MS sample is prepared by adding a known quantity of target analytes to a sample prior to sample digestion or extraction. In general, for organic compound and metal analyses, an MS/MSD pair is prepared and analyzed with each preparation batch or for every 20 samples. For inorganic compound analysis, a single MS and a laboratory sample duplicate are often prepared and analyzed with each batch. The MS results allow verifying the presence of matrix effects.

SAP Worksheet #30 – Analytical Services Table (Continued)

Surrogate Standards

Organic compound analyses include the addition, quantitation, and recovery calculation of surrogate standards. Compounds selected to serve as surrogate standards must meet all of the following requirements:

- Are not the target analytes
- Do not interfere with the determination of target analytes
- Are not naturally occurring, yet are chemically similar to the target analytes
- Are compounds exhibiting similar response to target analytes

Surrogate standards are added to every analytical and QC check sample at the beginning of the sample preparation. The surrogate standard recovery is used to monitor matrix effects and losses during sample preparation. Surrogate standard control criteria are applied to all analytical and QC check samples, and if surrogate criteria are not met, re-extraction and reanalysis may be performed.

Post-digestion Spikes and the Method of Standard Addition

A post-digestion spike is used during metal analysis to assess analytical interferences that may be caused by general matrix effects or high concentrations of analytes present in the sample. A digested sample is spiked with the analyte of interest at a known concentration, and the spike recovery is used to estimate the presence and the magnitude of interferences.

If a post-digestion spike recovery fails to meet acceptance criteria, the Method of Standard Addition (MSA) will be used to quantify the sample result. The MSA technique compensates for a sample constituent that enhances or depresses the analyte signal. To perform the MSA, known amounts of a standard at different concentrations are added to aliquots of digested sample, and each spiked sample and the original unspiked sample are analyzed. The absorbance is then plotted against the concentration, and the resulting line is extrapolated to zero absorbance. The point of interception with the concentration axis is the indigenous concentration of the analyte in the sample.

SAP Worksheet #30 – Analytical Services Table (Continued)

Preventive Maintenance

All instruments must be maintained in accordance with the manufacturers' recommended procedures. The laboratory must define in its QA plan the frequency and type of maintenance for each instrument. The laboratory must also record all maintenance activities in an instrument logbook. The laboratory must maintain the instruments in working condition required by the methods specified for the analyses. Sufficient redundancy in equipment must be available in the laboratory to handle downtime situations. Method substitution because of instrumental failure will not be permitted without approval from the Project Chemist or PRSO.

In addition to preventive maintenance, the laboratory must keep a sufficient supply of replacement parts on hand for those parts known to require frequent changes due to wear and tear or contamination. Whenever preventive or corrective maintenance is applied to an instrument, the laboratory must demonstrate the instrument's return to operating conditions and must recalibrate the instrument prior to resumption of sample analyses.

On-Site Laboratory Quality Objectives

New World Technology, Inc. (NWT) will perform gamma and alpha spectroscopy, ^{90}Sr analysis, gross alpha/beta, and low energy beta analyses using NWT's SOPs approved by the RASO. California DHS certification and NFESC evaluation are not required for the on-site radiological laboratory per written confirmation from DHS and EPA. Prior to analyzing project samples for ^{90}Sr and alpha spectroscopy, NWT will perform method validation. The on-site laboratory will receive Department of Defense Environmental Laboratory Accreditation Program certification before December 31, 2010, or when otherwise required by the DON.

On-Site Laboratory Sample Custody and Documentation

The integrity and traceability of samples from the time they are collected through the time data are reported are essential in any sampling and analysis program. The handling of the samples and transferring of custody must be well-documented given the evidentiary nature of the analytical data. A sample is considered to be in one's custody if it meets any of the following criteria:

1. In actual possession or in view of the person who collected the sample
2. Locked in a secure area

SAP Worksheet #30 – Analytical Services Table (Continued)

3. Placed in an area restricted to authorized personnel

The samples will be delivered to the person in the laboratory authorized to receive samples. Upon receipt of a sample, the sample condition is inspected, and verification of the information on the sample container is checked against that on the COC record. The sample is logged in the laboratory logbook. The sample will be stored in a secured room.

On-Site Laboratory Quality Control Requirements

The analytical laboratory must have written SOPs defining the instrumentation, calibration, method detection, and QC requirements. The SOPs must be available to the analysts performing the work. The SOPs must meet or exceed the requirements of the analytical methods cited in this SAP. The laboratory must maintain logs of all activities that have an impact on the quality of the laboratory results.

The laboratory must maintain the instruments in the working condition required by the methods specified for the analyses. Sufficient redundancy in equipment must be available in the laboratory to handle downtime situations.

Method Validation

Samples analyzed for ^{90}Sr and alpha spectroscopy will be performed by the NWT laboratory in accordance with approved SOPs (Attachment 2). The SOPs must be reviewed and approved by the RASO prior to analyzing field samples.

After method performance characteristics are determined, 12 samples will be analyzed by the NWT laboratory and the off-site laboratory for method validation. The 12 samples will be prepared from each of the three previously analyzed samples for ^{90}Sr and alpha spectroscopy. One sample with reported concentration below the RROs and two samples with concentration above the RROs will be selected.

The 12 samples will be prepared by splitting each of the three samples in half and then splitting each half into four equal halves. One set of four equal halves from each of the three samples will be given to the on-site laboratory to analyze and the other set will be given

SAP Worksheet #30 – Analytical Services Table (Continued)

to the off-site laboratory to analyze. Results will be reviewed by TtEC and the RASO in order to determine if the on-site laboratory method has been validated adequately such that the on-site laboratory can continue to analyze all field samples by those methods.

On-site Laboratory Quality Control Checks

The following subsections describe in detail the laboratory QC samples required for the on-site laboratory.

Laboratory Duplicates

Laboratory sample duplicates are prepared and analyzed with each batch of systematic samples for most analyses. Laboratory duplicate samples will be analyzed independently as appropriate. For this project, a laboratory duplicate will be prepared and analyzed by gamma spectroscopy for the on-site laboratory for each batch of systematic samples collected. A laboratory duplicate will be prepared and analyzed for the on-site laboratory for each batch of alpha spectroscopy and strontium samples. A batch is defined as the total number of systemtatic samples in a survey unit or less. The laboratory duplicate selection process is designed to be "blind" so that the process also applies to activities less than the MDA. It will also ensure that at least one sample per batch will be run for samples that report an isotopic activity above the MDA. If the sample analysis identifies no activity greater than the MDA to be present, the total activity of the sample will be used for comparison.

Calibration

All instruments and equipment must be calibrated in accordance with the manufacturer's requirements and/or laboratory SOPs. Each instrument must be calibrated with the standard appropriate to the type of instrument and the calibration range established for the method.

ICALs are performed when the method is first used and again whenever the continuing calibrations fail to meet their respective acceptance criteria. In addition, if the instrument undergoes significant maintenance, the ICAL must be repeated. Calibration of all equipment will be performed in accordance with the on-site laboratory's SOPs.

SAP Worksheet #30 – Analytical Services Table (Continued)

Continuing calibrations verify that the instrument performance has remained within the limits set at the time of the ICAL. The frequency of continuing calibrations is specified in referenced methods.

Instrument Blanks

Instrument backgrounds are run to ensure that contaminants from previous runs are out of the system and do not contaminate succeeding runs. Instrument backgrounds are performed before sample analyses are performed and after samples containing high concentrations of potentially interfering materials are found, in accordance with the NWT SOP.

Method Blanks

Method backgrounds are performed on a daily basis in the same manner as the samples, using the same container geometry used for samples. The purpose of the method backgrounds is to ensure that the equipment is free of contaminants that could interfere with the analysis.

Preventive Maintenance

All instruments must be maintained in accordance with the manufacturers' recommended procedures. The laboratory must define in its QA plan the frequency and type of maintenance for each instrument. The laboratory must also record all maintenance activities in an instrument logbook. The laboratory must maintain the instruments in working condition required by the methods specified for the analyses. Sufficient redundancy in equipment must be available in the laboratory to handle downtime situations. Method substitution because of instrumental failure will not be permitted without approval from the Project Chemist or PRSO.

In addition to preventive maintenance, the laboratory must keep a sufficient supply of replacement parts on hand for those parts known to require frequent changes due to wear and tear or contamination. Whenever preventive or corrective maintenance is applied to an instrument, the laboratory must demonstrate the instrument's return to operating conditions and must recalibrate the instrument prior to resumption of sample analyses.

SAP Worksheet #30 – Analytical Services Table (Continued)

Selection of Samples for Off-site Analysis for Quality Assurance Purposes

Samples are selected for quality assurance purposes to ensure that the DQOs are being met by the on-site laboratory. The selection process is designed to be "blind" so that the process also applies to samples with activities less than MDA. A minimum of ten percent of samples for each type of analysis will be sent to the off-site laboratory for independent verification of results. Quality assurance sample selection criteria will include:

- Ten percent of all samples, for each type of analysis, across all projects; and
- Ten percent of samples used to recommend unrestricted release of a survey unit, namely samples associated with the FSS sampling event

Samples will be selected based on indications of activity that are generally near the action level for the particular project. It will also ensure that at least one sample per isotope per batch will be run for samples above the quantification limit. This objective ensures that the on-site laboratory will meet the DQOs specified.

In addition, a performance evaluation (PE) sample of known activity concentrations, in an appropriate matrix will be obtained an analyzed by both laboratories. The radionuclides for this sample will be selected by the Program Chemist, and the concentrations will not be made available to either laboratory until they are both finished with the analysis. The PE analysis will be considered satisfactory if the laboratory indicated activity is within the specified tolerance range.

Detection and Quantification Limits

MDA

From Multi-Agency Radiological Laboratory Analytical Protocols, the MDA can be calculated as a sample-specific value. Typically, these values assumed both a Type I (α) and Type II (β) error of 5 percent. However, for project samples analyzed at the on-site and off-site laboratories, the project will utilize the MDL in calculations regarding MDA for gamma spectroscopy results. For purposes of and in discussions regarding gamma spectroscopy, any use of the term "MDA" will specifically describe the sample-specific MDL.

SAP Worksheet #30 – Analytical Services Table (Continued)

DL

The MDL is an estimate of the measured concentration at which there is 99 percent confidence that a given analyte is present in a given sample matrix. The MDL is the concentration at which a decision is made regarding whether an analyte is detected by a given method. The MDL can be calculated from replicate analyses of a matrix containing the analyte and is functionally analogous to the "critical value" or the "limit of detection."

For project sample results, gamma spectroscopy analysis software will utilize a mathematical model that ensures that the reported sample-specific MDA values are equivalent to the sample-specific MDL. Project decisions, in concert with the reported measurement results, can be made using the MDL.

QL

The QL is defined as the concentration of an analyte in a laboratory sample at which the measurement process gives results with a specified relative standard deviation. Unless otherwise specified in a specific method or SOP, this relative standard deviation is 10 percent.

QL calculations require the ability to estimate the standard deviation for the result of a hypothetical measurement and are not considered appropriate for use for gamma spectroscopy analysis. QLs are not utilized for gamma spectroscopy analysis.

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SAP Worksheet #31 – Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions (Title and Organizational Affiliation)
Operational Readiness Review	Prior to mobilization of the project and prior to initiating major phases of work	Internal	TtEC	Project Manager, TtEC	Project Manager, TtEC	Project Manager, TtEC	PQCM, TtEC
Field Sampling Surveillance	Once at the beginning, once during, and once toward the end of field sampling activities	Internal	TtEC	PQCM, TtEC	Project Manager, TtEC	Project Manager, TtEC	Project Manager and QCPM, TtEC
On-site Laboratory Audit	Once every six months during project duration	Internal	TtEC	QCPM, TtEC	On-site Laboratory Manager, NWT RSO, TtEC	On-site Laboratory Manager, NWT RSO, TtEC	QCPM, TtEC
Data Review Surveillance (off-site laboratory data)	Once every six months during project duration	Internal	TtEC	Program Chemist, TtEC	Project Chemist, TtEC	Program Chemist, TtEC	QCPM, TtEC
Data Review Surveillance (on-site laboratory data)	Once every six months during project duration	Internal	TtEC	PRSO, RSRS	RSO, TtEC	RSO, TtEC	QCPM, TtEC

SAP Worksheet #31 – Planned Project Assessments Table (Continued)

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions (Title and Organizational Affiliation)
Management Review	Once during the project duration	Internal	TtEC	QCPM, TtEC	Project Manager, TtEC	Project Manager, TtEC	PQCM, TtEC

SAP Worksheet #32 – Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Title and Organizational Affiliation)	Time Frame of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Title and Organizational Affiliation)	Time Frame for Response
Field Sampling Surveillance	Surveillance Report	Project Manager, TtEC	7 days after completion of the inspection	Corrective Action Report	Project Manager and QCPM, TtEC	5 days after notification
Data Review Surveillance (off-site laboratory data)	Surveillance Report	QCPM, TtEC	7 days after completion of the inspection	Corrective Action Report	QCPM, TtEC	14 days after notification
Data Review Surveillance (on-site laboratory data)	Surveillance Report	QCPM, TtEC	7 days after completion of the inspection	Corrective Action Report	QCPM, TtEC	14 days after notification
Management Review	Surveillance Report	Project Manager, TtEC	7 days after completion of the inspection	Corrective Action Report	Project Manager, TtEC	14 days after notification

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SAP Worksheet #33 – QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Field Sampling Surveillance Report	Once at the beginning, once during, and once towards the end of field sampling activities	TBD	PQCM, TtEC	Project Manager and QCPM, TtEC
Data Review Surveillance Report (off-site laboratory data)	Once after all data are generated and reviewed	TBD	Program Chemist, TtEC	Project Manager and QCPM, TtEC
Data Review Surveillance Report (on-site laboratory data)	Once after all data are generated and reviewed	TBD	RSO, TtEC	Project Manager and QCPM, TtEC
Management Review Report	Once after management review is completed	TBD	QCPM, TtEC	Project Manager and Program Manager, TtEC

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SAP Worksheet #34 – Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Title and Organizational Affiliation)
Field logbook	Field logbooks will be reviewed weekly and verified for information accuracy and completeness. The inspection will be documented in daily QC reports.	I	PQCM, TtEC
COC forms	COC forms will be reviewed daily upon their completion and verified for completeness.	I	PQCM, TtEC Project Chemist, TtEC PRSO, RSRS RSOR, TtEC
Sample receipt	For samples shipped via courier or FedEx, the Project Chemist will verify receipt of samples by the laboratory the day following shipment.	I	Project Chemist, TtEC
Sample logins	Sample login information will be reviewed and verified for accuracy and completeness in accordance with the requirements in this SAP.	I E	Project Chemist, TtEC Laboratory Project Manager, NWT/TestAmerica-St. Louis
Laboratory data prior to release	Laboratory data will be reviewed to verify that the requirements in this SAP have been met. Prior to release, data will be verified as follows:	E	Laboratory Project Manager, NWT/TestAmerica-St. Louis
	All data (100 percent) comply with the method- and project-specific requirements and any deviations or failure to meet criteria is documented for the project file.	E	Analyst, NWT/TestAmerica-St. Louis
	All manual entries (100 percent) are free of transcription errors and manual calculations are accurate; computer calculations are spot-checked to verify program validity; data reported are compliant with method- and project-specific QC requirements; raw data and supporting materials are complete; spectral assignments are confirmed; descriptions of deviations from method or project requirements are documented; significant figures and rounding have been appropriately used; reported values include dilution factors; and results are reasonable.	E	Peer Analyst, NWT/TestAmerica-St. Louis

SAP Worksheet #34 – Verification (Step I) Process Table (Continued)

Verification Input	Description	Internal/ External	Responsible for Verification (Title and Organizational Affiliation)
	Data reported are compliant with method- and project-specific QC requirements; the reported information is complete; the information in the report narrative is complete and accurate; and results are reasonable.	E	Supervisor, NWT/TestAmerica-St. Louis
	Data reported are compliant with method- and project-specific QC; analytical methods are performed in compliance with approved SOPs. This review may be conducted after release of data since reviews are done only on 10 percent of the data.	E	Quality Assurance Manager, NWT/TestAmerica-St. Louis
Laboratory data due at turnaround time listed on COC	Laboratory data will be verified for having been obtained following the protocols in this SAP and being of sufficient quality to satisfy DQOs.	I	Project Chemist, TtEC
Laboratory data packages	All laboratory data packages will be verified by the laboratory performing the work for completeness and technical accuracy prior to submittal. Data packages will then be reviewed by the Project Chemist for accuracy against faxed/e-mailed data and for completeness in accordance with the data package requirements described in Worksheet #29. Subsequently, data packages will be evaluated externally by undergoing third-party data validation as described in Worksheet #36.	E I I	Laboratory, NWT/TestAmerica-St. Louis Project Chemist, TtEC PRSO, RSRS
Field and electronic data	One hundred percent of manual entries will be reviewed against the hard-copy information and 10 percent of electronic uploads will be checked against the hard copy.	I I	Project Chemist, TtEC PRSO, RSRS

SAP Worksheet #35 – Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Title and Organizational Affiliation)
IIa	Field logbook	Field logbooks will be reviewed weekly for accuracy associated with each sampling event. The inspection will be documented in daily QC reports.	PQCM, TtEC
IIa	COC forms	COC forms will be reviewed daily to ensure that project information, sample analyses requested, number of field QC samples collected, and percent level III or IV validation chosen are accurate and in accordance with the requirements in this SAP.	PQCM, TtEC Project Chemist, TtEC PRSO, RSRS
IIa	Sample receipt	The sample cooler will be checked for compliance with temperature and packaging requirements listed in Worksheet #27 of this SAP.	Laboratory sample custodian, NWT/TestAmerica-St. Louis
IIa	Sample logins	Sample login will be reviewed for accuracy against the COC form.	Project Chemist, TtEC Laboratory Project Manager, NWT/TestAmerica-St. Louis
IIa	Laboratory data prior to release	Laboratory data will be reviewed to ensure that the data are accurate and meet the requirements in this SAP. Prior to release, data will be validated as follows:	Laboratory Project Manager, NWT/TestAmerica-St. Louis
		All data (100 percent) comply with the method- and project-specific requirements and any deviations or failure to meet criteria is documented for the project file.	Laboratory Analyst, NWT/TestAmerica-St. Louis
		All manual entries (100 percent) are free of transcription errors and manual calculations are accurate; computer calculations are spot-checked to verify program validity; data reported are compliant with method- and project-specific QC requirements; raw data and supporting materials are complete; spectral assignments are confirmed; descriptions of deviations from method or project requirements are documented; significant figures and rounding have been appropriately used; reported values include dilution factors; and results are reasonable.	Laboratory Peer Analyst, NWT/TestAmerica-St. Louis
		Data reported are compliant with method- and project-specific QC requirements; the reported information is complete; the information in the report narrative is complete and accurate; and results are reasonable.	Laboratory Supervisor, NWT/TestAmerica-St. Louis
		Data reported are compliant with method- and project-specific QC; analytical methods are performed in compliance with approved SOPs. This review may be conducted after release of data since only 10 percent of the data is reviewed.	Laboratory Quality Assurance Manager, NWT/TestAmerica-St. Louis

SAP Worksheet #35 – Validation (Steps IIa and IIb) Process Table (Continued)

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Title and Organizational Affiliation)
IIa	Laboratory data due at turnaround time listed on COC	Laboratory data will be reviewed to ensure that the data reported met the analyte list and limits listed in this SAP.	Project Chemist, TtEC PRSO, RSRS
IIa	Laboratory data packages	All laboratory data packages will be validated by the laboratory performing the work for technical accuracy prior to submittal.	Laboratory Project Manager, NWT/TestAmerica-St. Louis
		Data packages will then be reviewed for accuracy against the laboratory data that was faxed/e-mailed at the turnaround time listed on the COC.	Project Chemist, TtEC PRSO, RSRS
		Data packages will be evaluated externally by undergoing data validation as described in Worksheet #36.	Third-party data validator, LDC
IIb	Data validation reports	Data validation reports will be reviewed in conjunction with the project DQOs and data usability assessment (Worksheet #37).	Project Chemist, TtEC

SAP Worksheet #36 – Analytical Data Validation (Steps IIa and IIb) Summary Table

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (Title and Organizational Affiliation)
IIa	Soil/Water	All	In accordance with TestAmerica SOPs listed in Worksheet 23, NAVFAC SW EWI #1, and EPA Level III and IV guidelines	Laboratory Project Manager / TestAmerica-St. Louis
IIb	Soil/Water	All	In accordance with LDC's SOPs, NAVFAC SW EWI #1, and EPA Level III and IV guidelines	Third-party data validator / LDC

The following documents will be used as guidance for validating all data: Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA 540/R-99-008 (EPA 1999); Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540-R-04-004 (EPA 2004); EWI #1, 3EN2.1, Chemical Data Validation (SWDIV 2001a); Test Methods for Evaluating Solid Waste, Physical Chemical Methods, SW-846, Third Edition and final updates (EPA 1986); and the QC criteria specified in this SAP. Currently, there are no standards for data validation of radiological analyses. Therefore, guidance documents on validation of radiological data and modified functional guidelines will be used by the validator.

All sample results with the exception of off-site chemical waste characterization samples and on-site laboratory radiological results will be validated by an independent data validation company. Data will be validated at 80 percent EPA Level III and 20 percent EPA Level IV. Data validation will be performed by an independent data validation company. For this project, 80 percent of the data will require EPA Level III-equivalent data validation and 20 percent EPA Level IV-equivalent data validation. Data may be qualified as protocol or advisory. Protocol violations are when the laboratory deviates from the referenced analytical methods or the project-specific QLs, QC limits, or QC criteria. Advisory violations are when technical validation criteria have not been met.

Field QC samples will be discussed in the validation reports as follows:

- **Field Duplicates** – Field duplicate identifications will be provided on the COC form for each SDG by TtEC if collected. A section showing RPD values will be included to demonstrate field duplicate precision. If the results cannot be calculated, this will be noted in the report.
- **Field Blanks** – Identifications for field blanks, including trip blanks, equipment blanks, and source blanks, will be provided on the COC forms by TtEC. Any analyte detected above the QL in field blanks will be discussed in this section of the report.

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SAP Worksheet #37 – Usability Assessment

After the analytical data have been reviewed, verified, and validated in accordance with Worksheets #34 to 36, the TtEC Project Chemist will prepare a data quality assessment (DQA) report to assess data quality and usability. The DQA will include review of the following:

- Sample collection and analytical methods to verify that these were performed as discussed in Worksheets #14 and #17
- Field QC samples to verify that these were collected in accordance with Worksheet #12
- Project-specific QLs as listed in Worksheet #15 to verify that project-specific remedial goals were met
- DQOs to determine whether they have been achieved by the data collected
- Project-specific data quality indicators for precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters as discussed below

Analytical DQOs as assessed through the PARCC parameters are as follows.

Precision

Precision is the measure of the reproducibility of a set of replicate results or the agreement among repeat observations made under the same conditions. Analytical precision is the measurement of the variability associated with duplicate or replicate analyses. Field duplicate, laboratory duplicate, MSD, and LCSD (if analyzed) samples will be used to assess field and analytical precision. Precision measurements will be made from the on-site and off-site laboratories as appropriate by analysis. The precision measurement will be determined using the RPD between the duplicate sample results as follows:

$$\text{RPD} = 100 \times 2 \times (\text{result - duplicate result})/(\text{result + duplicate result})$$

The RPD limits for laboratory duplicate, MSD, and LCSD are presented in Worksheet #28, and the field duplicate limits are listed in Worksheet #12. Associated samples that do not meet the criteria will be evaluated by the validator.

For gamma spectroscopy, the indicated radionuclide concentrations between the on-site and off-site laboratory will be compared as follows:

- ^{137}Cs activity that is reported above the MDL or reporting limit from both laboratories
- ^{226}Ra activity that is reported above the MDL or reporting limit from both laboratories and the acceptance criterion is an RPD less than or equal to 30

SAP Worksheet #37 – Usability Assessment (Continued)

- ^{90}Sr activity that is reported above the quantification or reporting limit from both laboratories

The comparison will be performed using the RPD calculation, and the acceptance criteria are specified in Worksheet #28. Additionally, other radionuclides that may be present in samples from both laboratories may also be compared using an RPD less than or equal to 30.

On-site samples that were used in the remediation decision-making process that do not report positive activity will not have an RPD calculation performed. However, on-site sample results will still be compared with the off-site laboratory results to verify no activity is reported above the remediation limit. An RPD less than or equal to 30 is acceptable if the on-site laboratory reported activity is greater than the off-site laboratory activity without further investigation. Any off-site laboratory results greater than the remediation limit will be compared to the on-site laboratory results. If the on-site laboratory results did not report activity above the remediation limit, then an investigation will be conducted to resolve the discrepancy.

Accuracy

Accuracy is defined as the nearness of a result or the mean of a set of results to the true or accepted value. Analytical accuracy is measured by comparing the percent recovery (%R) of analytes spiked into a sample against a control limit. Spiked samples (typically from wet chemical analysis and separation processes) include MS, MSD, and LCS analyzed for every batch of up to 20 samples. They serve as a measure of analytical accuracy and surrogate standards added to all samples, blanks, MS, MSD, and LCS analyzed for organic contaminants to evaluate the method's accuracy and help to determine matrix interferences. %R is calculated as follows:

$$\%R = 100 \times (\text{spiked sample result - unspiked sample result})/\text{amount of spike added}$$

The laboratory will review the QC samples and surrogate standard recoveries for each analysis to ensure that the %R lies within the control limits listed in Worksheet #28. Otherwise, data will be flagged.

The on-site and off-site laboratories will typically calculate %R for analyses that require a radiochemical separation processes.

Representativeness

Unlike precision and accuracy, which can be expressed in quantitative terms, representativeness is a qualitative parameter. Representativeness is the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. It is a qualitative parameter that depends on proper design of the sampling program.

SAP Worksheet #37 – Usability Assessment (Continued)

Field personnel will be responsible for ensuring that samples are representative of field conditions by collecting and handling samples according to the procedures in this SAP. Errors in sample collection, packaging, preservation, or COC procedures may result in samples being judged non-representative and may form a basis for rejecting the data.

Completeness

Completeness is the percentage of measurements made that is judged to be valid. The completeness goal is to generate a sufficient amount of valid data to meet project needs. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not qualified with a rejected (R) flag. The requirement of completeness is 95 percent for samples and is determined using the following equation:

$$\% \text{ completeness} = 100 \times (\text{number of valid analyte results/number of possible results})$$

Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another, whether it was generated by a single laboratory or during interlaboratory studies. The use of standardized field and analytical procedures ensures comparability of analytical data.

Sample collection and handling procedures will adhere to EPA-approved protocols. Laboratory procedures will follow standard analytical protocols, use standard units and standardized report formats, follow the calculations as referenced in approved analytical methods, and use a standard statistical approach for QC measurements.

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NFESC (Naval Facilities Engineering Service Center). 1999. Navy Installation Restoration Chemical Data Quality Manual (IRCDQM). October.

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———. 2005. Environmental Work Instruction (EWI) EVR.6, Environmental Data Management and Required Electronic Delivery Standards.

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USACE (United States Army Corps of Engineers). 2003. Safety and Health Requirements (EM-385-1-1), and all applicable Occupational Safety and Health Administration (OSHA) requirements.

ATTACHMENT 1

EXAMPLE OF CHAIN-OF-CUSTODY, SAMPLE LABEL, CUSTODY SEAL, AND FIELD FORMS

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TETRA TECH
1230 Columbia Street, Suite 500
San Diego, CA 92101 (619) 234-8696

CHAIN-OF-CUSTODY RECORD

NUMBER 21700

PROJECT NAME	PURCHASE ORDER NO.	ANALYSES REQUIRED	LABORATORY NAME
PROJECT LOCATION	PROJECT NO.		
SAMPLER NAME	AIRBILL NUMBER		LABORATORY ID (FOR LABORATORY)
PROJECT CONTACT	PROJECT CONTACT PHONE NUMBER		

SAMPLE ID	DATE COLLECTED	TIME COLLECTED	NO. OF CONTAINER	LEVEL 3	LEVEL 4	TYPE	TAT										COMMENTS

Project Information Section
Do not submit to Laboratory

LOCATION	DEPTH START	DEPTH END	QC

RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)
COMPANY	TIME	COMPANY
RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)
COMPANY	TIME	COMPANY
RELINQUISHED BY (Signature)	DATE	RECEIVED BY (Signature)
COMPANY	TIME	COMPANY

LABORATORY INSTRUCTIONS/COMMENTS

COMPOSITE DESCRIPTION

SAMPLE CONDITION UPON RECEIPT (FOR LABORATORY)
TEMPERATURE: ______ SAMPLE CONDITION: ☐ INTACT ☐ BROKEN
COOLER SEAL: ☐ INTACT ☐ BROKEN

SAMPLING COMMENT:

White - Laboratory; Pink - Laboratory; Canary - Project File; Manila - Data Management

SAMPLE LABEL (EXAMPLE)

SAMPLE NO.:____
PROJECT:____
DATE:_____/_____/_____ **TIME:**_______________**HRS**__________
MEDIUM: WATER_____ **SOIL**_____ **SEDIMENT**_____________
OTHER________________________________**(Specify)**
TYPE: GRAB_____ **COMPOSITE**_____ **OTHER**______________
PRESERVATION:____________________________________
ANALYSIS:____
SAMPLED BY:____
REMARKS:____
____

CUSTODY SEAL (EXAMPLE)

CUSTODY SEAL

Person Collecting Sample:__________________________ Sample No.:_____
(Signature)
Date Collected:_____________ Time__________
____

ATTACHMENT 2

HUNTERS POINT SHIPYARD
STANDARD OPERATING PROCEDURES

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FINAL

HUNTERS POINT SHIPYARD PROJECT

Standard Operating Procedure

SAMPLING PROCEDURES
FOR RADIOLOGICAL SURVEYS

HPO-Tt-009

DCN: FWSD-RAC-O5-0473

Revision 1

Approved By:

	08/13/07
Radiation Safety Officer	Date
	08/13/07
Project Manager	Date

REVISION HISTORY

Revision (Date)	*Rev. No*	*Prepared By*	*Description of Changes*	*Affected Pages*
February 16, 2005	0	L. Bienkowski	Issued Final	All
April 25, 2006	1	L. Bienkowski	Updated contractor name from Tetra Tech FW, Inc. to Tetra Tech EC, Inc.	

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1.0 PURPOSE

This procedure will be used by Tetra Tech EC, Inc. (TtEC) personnel and its subcontractors at Hunters Point Shipyard (HPS) to perform swipe sampling and sampling of various types of media including soil, sediment, solid material (such as concrete, brick, porcelain, wood), and water. This procedure also details sample packaging and transporting samples to the laboratory.

2.0 SCOPE

This procedure shall be implemented by TtEC staff and subcontractor personnel when collecting samples on field projects related to radiological surveys at HPS.

3.0 MAINTENANCE

The Program Chemist is designated as the procedure owner and is responsible for updating this procedure. Final approval authority rests with the Project Manager.

4.0 RESPONSIBILITIES

The following personnel (or their qualified designee) will be directly involved with the sampling procedures discussed herein.

Program Chemist - The Program Chemist is responsible for updating this procedure as necessary. In addition, the Program Chemist will coordinate with the Radiation Task Manager (RTM) to ensure that samples are collected in conjunction with this procedure.

Radiation Task Manager – The RTM is responsible for ensuring that the conditions of this procedure are complied with during project sampling operations. The RTM shall ensure, by periodic personal observation, that samples are collected appropriately and chain-of-custody (COC) is controlled as described in this procedure. The RTM will also ensure that Radiological Control Technicians (RCTs) are qualified by training and experience to perform the requirements of this procedure and ensure that personnel under their cognizance observe proper precautions. The RTM will make a copy of this procedure available to the RCTs.

Radiation Safety Officer – The Radiation Safety Officer (RSO) is responsible for training personnel working with radioactive material. The RSO is responsible for the overall implementation and compliance with this procedure during all project operations. The RSO shall conduct periodic reviews, via personal observation of conducting radiation and contamination surveys, to ensure adherence to the requirements of this procedure.

Radiological Task Supervisor – The Radiological Task Supervisor (RTS) shall be responsible for assisting in the assignment of personnel that will perform the tasks required by this procedure. The RTS is responsible for the control of radioactive material samples, supervision of RCT's performing the requirements of this procedure, and to ensure that personnel under their cognizance observe proper precautions.

Radiological Control Technician – The Radiological Control Technician (RCT) shall be responsible for the performance of the requirements of this procedure and documentation of work performed. The RCT shall ensure compliance with this and any other referenced procedure.

5.0 DEFINITIONS AND ABBREVIATIONS

Swipe Samples – Swipe samples are materials, which after being wiped over a surface, are analyzed to determine the presence of removable radioactivity on the surface area that was wiped.

Soil Samples – Soil samples are defined as soil collected for analytical purposes. Soil samples will be collected from the top 15 centimeters (cm) of the surface, unless otherwise noted in the applicable work-planning document [e.g. a Task-specific Plan (TSP), Work Instruction or Work Plan].

Sediment Samples – Sediment samples are defined as a collection of clay, silt, sand, and/or gravel deposited by water, wind, or glaciers used for analytical purposes.

Solid Material Samples – Solid material samples are defined as pieces of concrete, brick, porcelain, wood, or any other hard material collected for analytical purposes from buildings or surrounding areas. The samples could include accumulations from ventilation systems or drain systems.

Liquid Samples – Liquid samples are defined as liquid collected for analytical purposes from sinks, drain piping, sewer systems, rinsate, groundwater, leachate, liquid investigation-derived waste, and low-point accumulation areas inside of buildings, sumps, and excavation pits.

6.0 SAMPLING PROCEDURE DETAILS

6.1 GENERAL PROCEDURES

Field instruments used for measurements required by this procedure shall be checked with standards and verified to have current calibration.

Anytime this procedure is in effect, the RTM (or qualified designee) should ensure, by periodic personal observation, that samples are appropriately collected and controlled.

Surface scan surveys are to be performed at each location before initiating sampling. This will identify the presence of gross contamination, which will require that samples and equipment be treated as radioactive and handled in accordance with applicable license requirements. Samples will be recorded on COC documentation.

6.2 SAMPLING PROCEDURE PROCESS

Sample activities will be recorded in the field logbook as directed by the Base-wide Sampling and Analysis Plan (SAP). Sampling personnel will don a new pair of disposable nitrile gloves immediately before collecting samples at each location.

6.2.1 SWIPE SAMPLING

Swipe samples will be obtained in accordance with HPO-Tt-006, *Radiation and Contamination Surveys*. Swipe samples will be documented in the sample logbook as applicable. Sample COC records shall be completed in accordance with the Base-wide SAP.

6.2.2 SOIL SAMPLING

Because standard surface soil contamination criteria for radionuclides are applicable to the average concentration in the upper 15 cm of soil, the sampling protocol described here is based on obtaining a sample of this upper 15 cm. Special situations, such as sampling at depths greater than 15 cm, evaluating trends or airborne deposition, determining near-surface contamination profiles, and measuring non-radiological contaminants, may require special sampling procedures. These special situations will be evaluated and incorporated into TSPs as the need arises.

Samples will be collected with a hand-auger, hollow-stem auger, split-spoon sampler, disposable scoop, or equivalent. The soil removed for sampling must be sufficient to yield a sample of sufficient volume for the sample container being used. Soil samples will be collected and handled as follows:

1. Loosen the soil at the selected sampling location to a depth of approximately 15 cm, using a trowel or other digging instrument.
2. Remove large rocks, vegetation and foreign objects. In some cases, however, these objects may be the source of the contamination and may be collected as separate samples for characterization.
3. Place as much soil as practical into a 250-milliliter (mL)-wide mouth plastic bottle or plastic 500-mL Marinelli container.

4. If sample containers are not readily available, samples may be collected in a plastic bag for subsequent transport to the laboratory for sample preparation.
5. Tape the cap of the container in place or seal the ziplock plastic bag.
6. Label the sample container in accordance with the Base-wide SAP.
7. Document all samples collected in the sample logbook as applicable. Sample COC records shall be completed in accordance with the Base-wide SAP.
8. Transport samples to the on-site laboratory for analysis as soon as possible after sample collection. Sample packaging and shipment procedures for transporting samples to an off-site laboratory are described in Section 6.3 of this procedure.
9. Clean or decontaminated tools will be used at each sampling location. Sampling tools will be decontaminated as described in the Base-wide SAP.

6.2.3 Sediment Sampling

Several methods are available to collect sediment samples. The tools used will be appropriate to the circumstances and may include use of trowels, augers, or other hand tools. Sediment sampling will be conducted as follows:

1. A hand-auger, trowel or similar device will be used to access each sampling location. The sample collection tool will be selected based on physical limitations accessing the sample location.
2. Place as much material as practical into a 250-mL-wide mouth plastic bottle or plastic 500-mL Marinelli container.
3. Follow steps 4 through 9 of Section 6.2.2 to complete sample collection.

6.2.4 Solid Material Sampling

Several methods are available to collect solid material samples. To collect samples, solid materials may need to be broken into smaller pieces. Solid materials will be collected as follows:

1. Break up the material into small enough pieces to fill a 250-mL-wide mouth plastic bottle or plastic 500-mL Marinelli container.
2. Follow steps 4 through 9 of Section 6.2.2 to complete sample collection.

6.2.4.1 Pipe and Drain Line Sampling

Pipe and drain line sampling is conducted to assess residual radioactivity that may be inside of drain lines or materials within sanitary sewer and storm drain systems.

1. Since the type of material found inside drain lines varies, there is no specific method identified to collect these samples. Samples may be collected using a plumber's snake, swabs, scraper, trowel, etc.
2. As much material as possible should be collected and placed into a 250-mL-wide mouth plastic bottle or plastic 500-mL Marinelli container
3. Follow steps 4 through 9 of Section 6.2.2 to complete sample collection.

6.2.4.2 Ventilation Sampling

Ventilation sampling will be performed to identify if the system is impacted and assess the residual radioactivity that may be present.

1. If visible dust is present inside the ventilation system, use a masslin cloth to accumulate the material into a pile. (If no visible dust is present, collect a swipe sample as discussed in HPO-Tt-006, *Radiation and Contamination Surveys*.)
2. Using a flat utensil such as a piece of paper or scraper carefully place as much material as possible into a 250-mL-wide mouth plastic bottle or plastic 500-mL Marinelli container.
3. Follow steps 4 through 9 of Section 6.2.2 to complete sample collection.

6.2.5 WATER SAMPLING

Water samples will be collected as follows:

1. Collect water using any of the following sampling equipment: disposable bailer, pump, coliwassa-type tube sampler, or equivalent. Care will be taken to avoid collection of bottom sediment or vegetation.
2. Fill completely a 250-mL-wide mouth plastic bottle, plastic 500-mL Marinelli container or two liter plastic bottles.
3. Follow steps 5 through 9 of Section 6.2.2 to complete sample collection.

6.3 SAMPLE PACKAGING AND TRANSPORT

Samples will be delivered for analysis to an on-site laboratory via a box, cooler, or similar container (ice is not required if only radiological analysis will be performed) along with the completed COC. Upon arrival at the on-site laboratory, the sampler will sign the "Relinquished By" on the COC, and the laboratory manager will sign the "Received By" on the COC. The white copy of the COC will be submitted with the final analytical report of data from the on-site laboratory to the TtEC project chemist, the pink and yellow copies will be maintained by the on-site laboratory for their project files, and the manila copy will be submitted to the TtEC project chemist. A duplicate of the manila copy may also be kept in the TtEC project file on site.

Ten percent of the solid or liquid samples analyzed by the on-site laboratory will be sent to an off-site laboratory for quality assurance purposes. Additional samples may be sent for off-site analysis, as described in applicable work planning documents. A new COC will be generated by the laboratory manager for samples designated for off-site laboratory analysis. Samples designated for transport off site will be packaged in accordance with applicable Department of Transportation (DOT) and International Air Transport Association (IATA) procedures. At a minimum, sample containers will be placed in a box, cooler, or similar container for shipment and packaged with bubble wrap or other materials as necessary to prevent container breakage.

For samples transported by an off-site laboratory courier, two custody seals will be taped across the lid of the box or cooler: one seal in the front and one seal in the back. The appropriate section(s) of the COC will be completed by the assigned courier. The box/cooler and the top two copies (white and pink) of the COC will then be released to the courier for transportation to the laboratory.

For samples shipped via a commercial carrier, the COC will include the airbill number, and the “Received By” box will be labeled with the commercial courier’s name. The top two copies (white and pink) of the COC will be sealed in a resealable bag and then taped to the inside of the sample cooler lid or placed inside the box. The yellow copy of the COC will be maintained by the on-site laboratory and the manila copy will be submitted to the TtEC project chemist. A duplicate of the manila copy may also be kept in the TtEC project file on site. The box/cooler will be taped shut with strapping tape as necessary. Two custody seals will be taped across the lid: one seal in the front and one seal in the back. The pouch for the airbill will be placed on the box/cooler and secured with clear tape. The airbill will be completed for priority overnight delivery and placed in the pouch. If multiple boxes/coolers are being shipped, then the original airbill will be placed on the box/cooler with the COC, and copies of the airbill will be placed on the other boxes/coolers. The number of packages should be included on each airbill (1 of 2, 2 of 2). Saturday deliveries should be coordinated in advance with the designated off-site laboratory and placement of “Saturday Delivery” stickers on each box and/or cooler to be shipped should be confirmed with the commercial courier prior to release. Prepared packages will also be surveyed prior to shipment.

7.0 RECORDS

Sample collection records will include field logbooks and COCs. These records will be completed and maintained in accordance with the Base-wide SAP.

8.0 REFERENCES

Number	***Title***
DCN: FWSD-RAC-05-0165	*Final Base-wide Radiological Sampling and Analysis Plan, Revision 0, February 16, 2005*
HPO-Tt-006	*Radiation and Contamination Surveys*

9.0 ATTACHMENTS

None.

APPENDIX B

PROJECT CONTRACTOR QUALITY CONTROL PLAN

APPENDIX B

FINAL

PROJECT CONTRACTOR QUALITY CONTROL PLAN

Revision 2
May 16, 2008

BASE-WIDE STORM DRAIN AND
SANITARY SEWER REMOVAL
HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA

DCN: FWSD-RAC-06-0675.R2

Prepared for:

Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

CONTRACT NO. N62473-06-D-2201
CTO NO. 0006

Prepared by:

TETRA TECH EC, INC.

1230 Columbia Street, Suite 750
San Diego, CA 92101-8536

Gregory D. Joyce

Greg Joyce
QC Program Manager

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Figure B.2-1 Project Organization Chart

ABBREVIATIONS AND ACRONYMS

AHA	Activity Hazard Analysis
BRAC PMO	Base Realignment and Closure Program Management Office
CHP	Certified Health Physicist
CIH	Certified Industrial Hygienist
CQC	Contractor Quality Control
CSO	Caretaker Site Office
CTO	Contract Task Order
DCN	Design Change Notice
DFW	definable feature of work
DoD	Department of Defense
DON	Department of the Navy
EHS	Environmental Health and Safety
EM	Engineer Manual
EPA	U.S. Environmental Protection Agency
FCR	Field Change Request
HPS	Hunters Point Shipyard
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
NCR	Nonconformance Report
NAVFAC SW	Naval Facilities Engineering Command, Southwest
NRC	Nuclear Regulatory Commission
NTR	Navy Technical Representative
PCQC	Project Contractor Quality Control
PjM	Project Manager
PQCM	Project Quality Control Manager
QAO	Quality Assurance Officer
QC	quality control
QCM	Quality Control Program Manager
^{226}Ra	radium-226
RASO	Radiological Affairs Support Office
RCT	Radiological Control Technician

ABBREVIATIONS AND ACRONYMS
(Continued)

ROC	radionuclide of concern
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager
RSO	Radiation Safety Officer
RTM	Radiological Task Manager
RTS	Radiological Task Supervisor
RWP	Radiation Work Permit
SAP	Sampling and Analysis Plan
SHSP	Site Health and Safety Plan
SHSS	Site Health and Safety Specialist
SOP	Standard Operating Procedure
TSP	Task-specific Plan
TtEC	Tetra Tech EC, Inc.
TtFW	Tetra Tech FW, Inc.
USACE	U.S. Army Corps of Engineers

1.0 INTRODUCTION

This Project Contractor Quality Control (PCQC) Plan describes the procedures and methods to be implemented for the removal action of base-wide storm drain and sanitary sewer removal at Hunters Point Shipyard (HPS), San Francisco, California. The Department of the Navy (DON), represented by the Base Realignment and Closure Program Management Office (BRAC PMO) West, Naval Facilities Engineering Command, Southwest (NAVFAC SW), and the Radiological Affairs Support Office (RASO), are directing this removal action. This removal action is being performed under Remedial Action Contract No. N62473-06-D-2201, Contract Task Order (CTO) No. 0006. This PCQC Plan fulfills the requirements of the Tetra Tech EC, Inc. (TtEC) quality control (CQC) system requirements.

1.1 BACKGROUND

Upon review of the site's operational history, previous radiological investigations, and The *Final Historical Radiological Assessment, Volume II* (Naval Sea Systems Command, 2004), the storm drains and sanitary sewer contain localized radioactive contamination. Cesium-137, radium-226 (^{226}Ra), and strontium 90 are identified as radionuclides of concern (ROCs). The radiological remedial objectives that will be adopted have been established by the Department of the Navy in consonance with U.S. Environmental Protection Agency, Region IX.

The general approach to removing and surveying the storm and sanitary sewer lines will be to 1) remove overburden soils to within 1 foot of each line, 2) remove the lines and peripheral soil within 1 foot of each line, 3) plug open sewer or storm drain lines, left in place during the removal process, to prevent water from entering or exiting pipes, 4) conduct ex situ radiological screening and sampling of the pipeline and peripheral soil, and 5) conduct Final Status Surveys of the overburden soils and exposed excavation trench surfaces. After the results of these activities are evaluated and any identified radiological contamination is removed, the trench excavations will be backfilled and the site restored.

1.2 PURPOSE

The purpose of this PCQC Plan is to establish the specific procedures and methods for field inspections, and to provide an effective quality control (QC) system to ensure the quality of all work performed by TtEC and its subcontractor personnel for the removal activities. This plan is applicable to all field operations and will be available at the project field office. All work activities will be conducted in accordance with the Final Base-Wide Storm Drain and Sanitary Sewer Removal Work Plan (TtEC, 2006) and Parcel-specific Design Plans (to be developed later).

2.0 ORGANIZATION AND RESPONSIBILITIES

2.1 INTRODUCTION

This section describes management of the project including organizational, structural, and functional responsibilities.

2.2 ORGANIZATION

Project personnel will be organized to facilitate effective communication and to ensure that organizational lines of communication, roles and responsibilities, and reporting requirements are well defined. The organization will be defined to a level sufficient to ensure that each participant, whose actions could affect the quality of radiological task planning, field or laboratory operations, or reporting, has an understanding of his/her responsibilities and how these responsibilities fit into the overall team. The project organization chart is provided in Figure B.2-1.

The project personnel with the primary responsibilities for the achievement and verification of the project's radiological goals and objectives are the Project Manager (PjM), Certified Industrial Hygienist (CIH), Quality Control Program Manager (QCM), Construction Manager, Project Quality Control Manager (PQCM), Certified Health Physicist (CHP), Radiation Safety Officer (RSO), Site Health and Safety Specialist (SHSS), Radiological Task Manager (RTM) and Supervisors, Radiological On-site Laboratory Supervisors, and Radiological Control Technicians (RCTs) and quality control representatives. Their roles and responsibilities are described in the following sections. DON oversight of the activities performed by the project team will be provided by RASO, BRAC PMO West, and NAVFAC SW personnel.

2.2.1 Project Manager

The PjM is responsible for the direction, execution, and successful completion of project tasks to achieve overall project goals. The PjM has the primary responsibility for coordinating activities and concerns with the DON Remedial Project Manager (RPM) and RASO. The PjM also has the responsibility and authority to perform the following:

- Coordinating work activities of subcontractors and TtEC personnel and ensuring that all personnel adhere to the administrative and technical requirements of the project
- Monitoring and reporting the progress of work and ensuring that project deliverables are completed on time and within budget
- Ensuring adherence to the requirements of the contract, project scope of work, and the project plans

- Ensuring that all work activities are conducted in a safe manner in accordance with the Site Health and Safety Plan (SHSP)
- Attending required meetings, including the pre-construction conference, weekly QC meetings, pre- and post-construction site inspections, and other scheduled and unscheduled meetings
- Serving as the senior contact between the DON and TtEC for actions and information related to the work
- Ensuring effective implementation of the radiological record management program
- Ensuring that all personnel assigned to perform fieldwork are appropriately monitored for exposure to ionization radiation
- Coordinating regulatory site visits

2.2.2 Certified Industrial Hygienist

The CIH has authority to implement and oversee the TtEC Health and Safety Program. The CIH has the responsibility and authority to perform the following:

- Ensuring that all staff, including subcontractors, comply with the SHSPs, state and federal regulations, and corporate policies
- Interacting with the PjM on all aspects of health and safety from the initial planning phase through fieldwork and closeout
- Providing advice and assistance on any safety, industrial hygiene, or accident prevention issue to the SHSS, PjM, and Construction Manager
- Reviewing all site health and safety documents and cost estimates, and working to properly staff projects
- Working to pre-qualify field subcontractors

2.2.3 Quality Control Program Manager

The QCM will report directly to the Director of Quality Programs and has the responsibility and authority to perform the following:

- Establishing and maintaining the QC program for the project
- Overseeing the QC program including data acquisition
- Working directly with the PjM and NAVFAC SW Quality Assurance Officer (QAO) to ensure implementation of the Program QC Plan
- Acting as a focal point for coordination of all QC project-related matters and resolving all QC issues
- Providing QC direction and training to the PQCM and others who are performing QC functions

- Suspending project activities if quality standards are not maintained
- Interfacing with the DON, including the NAVFAC SW QAO, on quality-related items
- Conducting field QC audits to ensure that site QC plans are being followed
- Performing reviews of audit and surveillance reports conducted by others
- Implementing DON technical direction letters related to QC topics

2.2.4 Construction Manager

The Construction Manager will report to the PjM and is responsible for coordinating, directing, implementing, and supervising site construction and support activities. The Construction Manager has the responsibility and authority to perform the following:

- Implementing field activities in accordance with the Work Plan
- Scheduling and directing field activities, support personnel, and subcontractors
- Administering site access and communication within active work areas
- Maintaining work site, facilities, vehicles, and equipment
- Ensuring that all work activities in the field are conducted in a safe manner and in accordance with the health and safety plans
- Coordinating and maintaining logistics of components of on-site tasks, including personnel and equipment
- Attending required meetings, including the pre-construction conference, weekly QC meetings, pre- and post-construction site inspections, and other scheduled and unscheduled meetings
- Preparing status reports and estimating future scheduling needs
- Preparing Daily Contractor Production Reports

2.2.5 Project Quality Control Manager

The PQCM is responsible for overall management of project QC and will report to the QCM. The PQCM or an alternate PQCM will be on site at all times during field activities. The PQCM has the responsibility and authority to perform the following:

- Monitoring activities to ensure conformance with the Work Plan and that policies, procedures, contract specifications, and sound practices are followed
- Preparing the Daily QC Reports
- Ensuring that the three phases of inspection (preparatory, initial, and follow-up) are implemented for all definable features of work (DFWs)
- Ensuring that required tests and inspections are performed and the results reported

- Attending required meetings, including the pre-construction conference, weekly QC meetings, pre- and post-construction site inspections, and other scheduled and unscheduled meetings
- Issuing and maintaining Field Change Requests (FCRs) and Nonconformance Reports (NCRs) for project activities (construction- and radiological-related)
- Maintaining an NCR and FCR log
- Ensuring that planning documents are current and controlled
- Maintaining the Submittal Register and a Submittal Log
- Stopping work not in compliance with the contract

2.2.6 Certified Health Physicist

The CHP is responsible for implementing, directing, and supervising all radiological project-related activities. The CHP has the responsibility and authority to perform the following:

- Assisting in the development and approval of the SHSP
- Assisting in identifying radiological analysis needs
- Providing technical support in subcontractor selection
- Providing health physics guidance on an as-needed basis
- Providing radiological control protection services, if required
- Directing and assisting project personnel in proper completion of radiological records
- Assisting the RSO to determine if an external dose is to be assigned to an individual who reported lost or damaged dosimetry devices
- Ensuring that the required radiological safety training is provided to project personnel
- Reviewing and approving project field procedures that involve the handling of radioactive materials or access to radiological areas
- Ensuring timely and thorough review of records, in accordance with the TtEC radiological records procedure, prior to approval
- Approving records with verifiable signature and date once records meet the quality standards as described in the radiological records procedure
- Conducting radiation incident investigations
- Conducting radiological project inspections
- Conducting data assessment

2.2.7 Radiation Safety Officer

The RSO will be responsible for oversight of the inspection and certification activities for radiological safety-related activities. The duties specified for the RSO may be shared with the CHP, as appropriate. In accordance with DON requirements, the RSO or a qualified designee will be on site during radiological work conducted under this Work Plan. The RSO has the responsibility and authority to perform the following:

- Providing radiological material-related safety briefings
- Ensuring that specified radiological safety procedures are followed and that the radiological safety tests and inspections are complete and acceptable
- Conducting daily oversight and field safety inspections and tests required by the project technical specifications and applicable professional standards
- Attending required meetings, including the pre-construction conference, weekly QC meetings, pre- and post-construction site inspections, and other scheduled and unscheduled meetings
- Serving as a contact person for lost or damaged dosimeters for TtEC staff
- Conducting search, investigating, and then documenting dosimeters reported lost or damaged for TtEC staff
- Ensuring that an individual who reported a lost or damaged dosimeter is excluded from a radiologically controlled area until the investigation is completed, documented, and the dosimetry device re-issued for TtEC staff
- Reviewing the exposure condition of an individual who reported lost or damaged dosimetry in order to assign an external dose with concurrence of the CHP
- Ensuring that each individual working at an impacted area wears a dosimetry device specified in the Radiation Work Permit (RWP)
- Verifying compliance with on-site RWPs and Standard Operating Procedure (SOPs) (including laboratory SOPs)
- Ensuring that all radiological safety documentation is provided to the PQCM for inclusion in the project files
- Providing surveillance of radiological-related activities
- Serving as a contact person for Nuclear Regulatory Commission (NRC) site inspections
- Stopping work not in compliance with RWPs, good radiological practices, and SOPs

2.2.8 Site Health and Safety Specialist

The SHSS ensures that all elements of the approved SHSPs are implemented and enforced on site. The SHSS will report directly to the CIH and will assist in implementing and enforcing the SHSP in the field. The SHSS has full authority to issue stop work orders or evacuation orders where work operations or noncompliance(s) may threaten the health and safety of site workers or the public. The SHSS has the responsibility and authority to perform the following:

- Ensuring that all personnel understand the requirements of the TtEC Environmental Health and Safety (EHS) program and procedures through training and communication
- Ensuring enforcement of SHSPs by means of daily site inspections
- Investigating all accidents, injuries, illnesses, near-misses, and other incidents
- Ensuring that project personnel are trained on the dangers of hazardous substances on the project, maintaining Material Safety Data Sheet files to provide easy access to project personnel, and performing inspections to ensure that all waste containers are correctly labeled
- Ensuring that the TtEC SHSP is read, understood, and signed by all personnel including subcontractors
- Ensuring that tailgate safety meetings are conducted on days that work is performed and that documentation of all meetings and any other additional training is completed
- Verifying that project safety equipment is inspected, as required by the EHS program
- Coordinating site health and safety requirements with the Construction Manager and PjM
- Ensuring maintenance of all health and safety monitoring equipment and personal protective equipment and directing site monitoring activities
- Coordinating daily field activities with the Construction Manager
- Coordinating site safety and emergency response duties; verifying site communications system with site personnel
- Performing inspection of safety equipment
- Reporting to the Resident Officer in Charge of Construction (ROICC) within 2 hours; all incidents are required to be reported by Engineer Manual (EM) 385-1-1 (United States Army Corps of Engineers [USACE], 2003); and immediately reporting to the ROICC any fatal injury, one or more persons admitted to a hospital, or property damage to government property
- Verifying that all personnel have the necessary training and medical clearance prior to entering the exclusion zone or contamination reduction zone at the site; informing the Construction Manager of any site personnel with medical restrictions
- Determining and posting routes to medical facilities and emergency telephone numbers arranging for emergency transportation to medical facilities
- Serving as the Project Hazard Communication Coordinator
- Maintaining training records and medical certifications for all on-site personnel including subcontractors

- Initiating necessary revisions or changes to the SHSP
- Maintaining site-control procedures
- Maintaining current records of certification for first aid and cardiopulmonary resuscitation for project field personnel
- Attending required meetings, including the pre-construction conference, weekly QC meetings, pre- and post-construction site inspections, and other scheduled and unscheduled meetings

2.2.9 Radiological Task Managers

The RTMs will plan, direct, and coordinate radiological activities ensuring that requirements, goals, and objectives of the project are accomplished. The RTMs have the responsibility and authority to perform the following:

- Reviewing project plans to determine scheduling and procedures for accomplishing project objectives
- Ensuring that the RTM or a similarly qualified designee will be on site during radiological activities
- Distributing and collecting dosimetry devices
- Performing dosimetry program reviews
- Determining accumulated external dose of workers, documenting dose in NRC Form 4, and providing a copy to each worker
- Determining requirements for work assignments including personnel monitoring devices
- Determining and providing for radiological staffing for each phase of the project and arranging for assignment of project personnel
- Conferring with project staff to outline Work Plan and to assign duties, responsibilities, and scope of authority
- Attending required meetings, including the pre-construction conference, weekly QC meetings, pre- and post-construction site inspections, and other scheduled and unscheduled meetings
- Reviewing reports prepared by project personnel and modifying schedules or plans as required
- Preparing project reports
- Conferring with project personnel to provide technical advice and to resolve problems
- Coordinating project activities with the activities of regulatory or other governmental agencies, as directed by the PjM
- Notifying the PjM, RPM, and RASO regarding radioactive anomalies

- Managing the storage of radioactive waste in accordance with the radioactive material license
- Implementing and monitoring on-site radiological training programs

2.2.10 Program Chemist

The Program Chemist oversees sample collection, handling, analysis, and analytical data reporting. The Program Chemist has responsibility and authority for the following:

- Developing Sampling and Analysis Plan (SAP)
- Evaluating and selecting qualified subcontract laboratories
- Implementing data QC procedures and performing audits of field performance
- Reviewing off-site laboratory data prior to use
- Ensuring that proper review of on-site laboratory data is performed
- Coordinating data validation of off-site laboratory data
- Reviewing data validation reports
- Preparing analytical reports and supporting project report preparation

2.2.11 Radiological Task Supervisors

Radiological Task Supervisors (RTSs) will direct field survey personnel and health physics operations as assigned by the RTMs. The RTSs have the responsibility and authority to perform the following:

- Performing the functions enumerated in the Work Plan
- Supervising field staff for survey, site remediation and decontamination, use of survey equipment and instrumentation, and support of programs and projects
- Ensuring compliance by RCTs with the applicable SOPs for safety program, survey, and/or remediation actions
- Ensuring compliance with NRC, Occupational Safety and Health Administration, and EPA directives, as well as applicable local, state, and federal statutes and codes
- Interpreting and verifying data accumulated from surveys and monitoring activities
- Maintaining inventory and ensuring safe use and serviceability of tools, equipment, and vehicles on site
- Informing the RTM of work progress
- Ensuring that each individual working at an impacted area complies with the requirements specified in the RWP

2.2.12 Radiological On-site Laboratory Supervisors

The Radiological On-site Laboratory Supervisors will maintain oversight of the on-site laboratory program. The Radiological On-site Laboratory Supervisor has the responsibility and authority to perform the following:

- Maintaining laboratory equipment
- Running calibration checks and maintaining calibration data
- Maintaining chain of custody of on-site samples while in their possession; ensuring correct shipment of off-site confirmation samples
- Verifying on-site laboratory results with those obtained from the off-site laboratory
- Communicating analytical needs and capabilities
- Implementing the SOPs and laboratory quality assurance manual
- Providing training to staff regarding laboratory quality assurance policies
- Making recommendations for corrections and improvements as necessary
- Establishing and maintaining statistical limits for QC measurements

2.2.13 Radiological Control Technicians

The RCTs will support projects in the field and laboratory. The RCT has the responsibility and authority to perform the following:

- Conducting and documenting field surveys, sampling, and laboratory support in accordance with the Work Plan and SOPs
- Interpreting and verifying field data accumulated from surveys and monitoring activities
- As assigned, assisting in training support personnel in health physics and safety
- Supporting dose assessments, and ensuring compliance with QC programs, emergency plans, and procedures
- Performing effluent monitoring and radioactive material inventories
- Performing survey equipment efficiencies, response checks, and daily checks of the survey instruments
- Conducting safety evaluations of health physics field and laboratory equipment
- Preparing and implementing use of RWPs, including being present at active work areas to ensure compliance with the RWPs in the absence of the RTS

2.2.14 Radiological Support Personnel

Radiological support personnel are equipment operators and laborers performing field activities in support of survey activities under the direction of the Construction Manager. The equipment operators will maintain and operate heavy equipment. The laborers will support various field activities directed by the Construction Manager or his designee.

2.2.15 Remedial Project Manager

The RPM has primary responsibility within the DON for day-to-day management of the project activities performed under this Work Plan and for its successful completion. The RPM's duties and authority include:

- Performing project management for the DON
- Ensuring that the project scope of work requirements are fulfilled
- Overseeing the project cost and schedule
- Providing formal technical direction to the TtEC project team, as needed
- Integrating Comprehensive Environmental Response, Compensation, and Liability Act issues at HPS with ongoing radiological activities
- Coordinating with the RASO and RPMs of other projects being performed in radiologically impacted areas to ensure that proper controls are in place
- Acting as lead interface with agencies on non-radiological issues
- Together with the Radiological Site Manager, negotiating radiological release criteria with regulatory agencies

2.2.16 Radiological Site Manager

As a representative of the RASO, the Radiological Site Manager has primary responsibility within the DON for the technical accuracy and the regulatory conformance of work performed under this PCQC Plan. The Radiological Site Manager's duties and authority include the following:

- Reviewing and approving project Work Plans and procedures
- Acting as lead interface with regulatory agencies on radiological survey plans and reports
- Together with the RPM, negotiating radiological release criteria with regulatory agencies
- Reviewing and approving on-site laboratory analytical data
- Reviewing and approving project reports
- Ensuring compliance with applicable *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM), *NUREG-1575* (Department of Defense [DoD] et al., 2000) requirements

- Recommending changes in TtEC's scope to the RPM, as appropriate
- Supporting public meetings

2.2.17 Quality Assurance Officer

The QAO is the DON representative with primary responsibility for ensuring that contract-required quality assurance measures are in place and effective for the work performed under this PCQC Plan. The QAO's duties and authority include:

- Reviewing and approving SAPs
- Providing DON oversight of the TtEC Quality Assurance Program
- Providing quality-related directives through Contracting Officer Representative
- Providing technical and administrative oversight of TtEC surveillance audit activities
- Acting as point of contact for matters concerning quality assurance and the DON's Laboratory Quality Assurance Program
- Coordinating training on matters pertaining to generation and maintenance of quality of data
- Authorizing the suspension of project execution if quality assurance requirements are not adequately followed

2.2.18 Resident Officer in Charge of Construction

The ROICC staff have the primary responsibility for providing on-site quality assurance and safety oversight of contractors performing work at HPS. The ROICC staff member's duties and authority include:

- Verifying that all work has been completed per contract and technical specifications prior to final government acceptance
- Performing ongoing field inspections to verify that all work is in compliance with both contract and technical specifications
- Notifying TtEC of any work not in compliance
- Interacting with the TtEC PQCM on quality-related issues
- Reviewing and signing waste manifests for non-radiological wastes as the generator's representative
- Reviewing contractor daily reports for completeness and accuracy
- Attending preparatory phase, initial phase, pre-final, and final acceptance inspections
- Attending weekly QC meetings

3.0 DEFINABLE FEATURES OF WORK

The DFWs establish the measures required to verify both the quality of work performed and compliance with specified requirements, and include inspecting materials and workmanship before, during, and after each DFW. Detailed descriptions of each DFW and the required phases of control will be developed for each Parcel-specific Design Plan.

4.0 QUALITY CONTROL MEETINGS

4.1 COORDINATION AND MUTUAL UNDERSTANDING MEETING

Prior to start of site work, the PjM will conduct a pre-construction kickoff meeting with the RPM, ROICC/Navy Technical Representative (NTR), and Caretaker Site Office (CSO) to discuss the QC program required by this contract. The purpose of this meeting is to develop a mutual understanding of the QC details, including forms to be used, administration of on-site and off-site work, coordination of the field activities, production, and the PQCM duties with the ROICC. At a minimum, the personnel required to attend the meeting shall include the PjM, Construction Manager, PQCM, and RSO. Minutes of the meeting shall be prepared by the PQCM and signed by the PjM and the RPM and/or ROICC/NTR or designated representative. This meeting may be held as part of a normally scheduled CQC meeting for a specific CTO.

4.2 QC MEETINGS

After the start of field activities, the PQCM will conduct QC meetings at a frequency of once per week or as required by the ROICC/NTR. The meetings will be held at the project site and will be attended by the ROICC/NTR, CSO, PjM, PQCM, RSO, SHSS, and the Construction Manager. The PQCM will notify the ROICC/NTR at least 48 hours in advance of each meeting. The following shall be accomplished at each meeting:

- Review the minutes of the previous meeting.
- Review the schedule.
  - Work or testing accomplished since last meeting
  - Rework items identified since last meeting
  - Rework items completed since last meeting
- Review the status of submittals.
  - Submittals reviewed and approved since last meeting
  - Submittals required in the near future
- Review the work to be accomplished in the following 2 weeks and documentation required. Schedule the three phases of control and testing.
  - Establish completion date for rework items
  - Required preparatory phase inspections
  - Required initial phase inspections
  - Required follow-up phase inspections
  - Required testing
  - Status of off-site work or testing
  - Required documentation

- Resolve QC and production problems.
- Address items that may require revisions to the PCQC Plan.

5.0 INSPECTION PROCESS

5.1 PREPARATORY PHASE INSPECTION

The PQCM will conduct preparatory phase inspections prior to starting the DFWs identified for each Parcel-specific Design Plan. These inspections shall include the following:

- Reviewing the Work Plan and drawings
- Ensuring that all materials and/or equipment have been tested, submitted, and approved
- Ensuring that provisions have been made to provide required control inspection and testing
- Examining the work area to ensure that all required preliminary work has been completed and is in compliance with the approved Work Plan requirements
- Physically examining the required materials and equipment to ensure that they are properly delivered to the site, conform to approved shop drawings or specifications, and are properly stored
- Reviewing the appropriate Activity Hazard Analysis (AHA) to ensure that safety requirements are met
- Discussing procedures for conducting the work, including potential repetitive deficiencies
- Documenting construction tolerance and workmanship standards for the particular phase of work
- Ensuring that the PCQC Plan for the work to be performed has been accepted by the DON

The PjM, RPM, ROICC/NTR, and the CSO shall be notified at least 2 working days in advance of preparatory phase activity. This phase shall include a meeting conducted by the PQCM and attended by the Construction Manager and any other personnel involved in performing the DFW.

The issues discussed during the preparatory phase meetings will be documented on the Preparatory Inspection Checklist (Attachment 1). The PQCM will direct personnel performing work activities as to the acceptable level of workmanship required.

5.2 INITIAL PHASE INSPECTION

An initial inspection will be performed at the beginning of a DFW and will include the following:

- A check of preliminary work to ensure that it is in compliance with contract requirements
- A review of the Inspection Checklist documenting results of the preparatory meeting
- Verification of full contract compliance, including required control inspection and testing
- Establishment of the required level of workmanship and verification to ensure that work meets minimum acceptable standards
- Resolution of all differences
- A check of safety requirements to include compliance with and upgrading of the SHSP and AHA
- A review of the AHA with project personnel

The PjM, the RPM, ROICC/NTR, and CSO will be notified at least 2 working days in advance of any initial phase activity. The PQCM will document initial inspections for each item using the Initial Inspection Checklist (Attachment 1) and attach it to the Daily CQC Report (Attachment 1). The exact location of the initial phase inspection will be indicated for future reference and comparison with follow-up inspections.

An initial phase inspection will be conducted each time a new crew arrives on site or any time acceptable specified quality standards are not being met.

5.3 FOLLOW-UP PHASE INSPECTION

During the completion of a particular work feature, follow-up inspections will be conducted to ensure continued compliance with contract requirements. The frequency of the follow-up inspections will depend on the extent of the work being performed on each particular feature. Each follow-up inspection will be documented on the Follow-up section of the Daily CQC Report. A final follow-up check will be conducted on any completed work phase prior to the commencement of a subsequent phase. Any deficiencies will be corrected prior to starting additional phases of work or will be identified on a list of items that do not conform to the specified requirements or are incomplete.

5.4 ADDITIONAL PREPARATORY AND INITIAL PHASES

The PQCM may conduct additional preparatory and initial inspections on the same DFWs under the following circumstances:

- If the quality of ongoing work is unacceptable, as determined by the PQCM, PjM, RPM, ROICC/NTR, or CSO
- If there are substantial changes in the staff, on-site supervision, or work crew
- If work on a DFW is resumed after a substantial period of inactivity
- If other problems develop

5.5 COMPLETION INSPECTION

Completion inspections will be performed as summarized in this section.

5.5.1 Pre-final Inspection

The PjM will conduct the pre-final inspection. The RPM, ROICC/NTR, CSO, PQCM, and other primary management representative(s), as applicable, will attend. The PjM will schedule the pre-final inspection in response to notification from the PQCM prior to the planned inspection date. The PQCM is required to verify at this time that all specific items previously identified as being unacceptable, along with all remaining project work, will be complete and acceptable by the scheduled date for the pre-final inspection. At this inspection, the ROICC/NTR will develop a list of incomplete and/or unacceptable work performed under the contract and will provide this list to TtEC.

5.5.2 Final Acceptance Inspection

The PjM will schedule the final acceptance inspection based on notification from the PQCM of readiness. The RPM, ROICC/NTR, CSO, PQCM, and other primary management representative(s), as applicable, will attend. Notification will be provided prior to the planned final acceptance inspection date and must include verification that all specific items previously identified as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection.

5.6 INSPECTION DOCUMENTATION

The PQCM is responsible for the maintenance of the inspection records. Inspection records will be legible and clearly provide all necessary information to verify that the items or activities inspected conform to the specified requirements, or in the case of nonconforming conditions, provide evidence that the conditions were brought into conformance or otherwise accepted by the ROICC/NTR. All inspection records will be made available to the DON.

6.0 QUALITY CONTROL SURVEILLANCE

6.1 SURVEILLANCE PROGRAM

The PQCM is responsible for the development and implementation of a site-specific surveillance program. Surveillances shall be performed to measure conformance with procedural requirements of the Base-wide Work Plan and Parcel-Specific Design Plans. At a minimum, surveillances will be conducted for the following aspects of sewer and storm drain removal:

Excavation of Soils and Removal of Piping and Systems

- Excavation approach and handling of soils
- Backfill and compaction
- Soil Stockpiling
- Erosion and sediment control

Radiological Surveys and Sampling of Excavated Material

- Radiological surveying and sampling of removed piping
- Sediment sampling
- Radiological surveying of excavated material
- Radiological sampling of excavated material

Final Status Surveys

- Radiological sampling of trench survey units
- Radiological sampling of overburden survey units

Radiological Control

- Radiation work permits
- Radiation detection instrumentation
- On-site radiological laboratory
- Radiological waste management

6.2 DEVELOPMENT OF CHECKLIST

The PQCM is responsible for developing checklists to document the scope of the surveillance conducted and any deficiencies noted. Surveillances can be conducted by any QC staff or any subject matter expert under the direction of the PQCM. Surveillance reports will be completed within 5 days of the performance of the surveillance and issued to the responsible party, the PM, and the Program QC Manager at a minimum. The surveillance report will identify the time that a response or a corrective action is required and whether verification of the action is required.

6.3 SURVEILLANCE LOG AND SCHEDULE

The PQCM will maintain a surveillance log that tracks the surveillance date, scope of surveillance, whether any deficiencies were noted, and when corrective actions were completed. The PQCM will maintain a surveillance schedule to help ensure that all aspects of project activities are evaluated in a timely manner concurrent with work activities.

7.0 NONCONFORMANCES

The PQCM documents any work or materials not conforming to the technical specifications or project/contract requirements on an NCR (Attachment 1). The NCR will detail the nonconforming condition, the recommended corrective action(s), and the disposition of the corrective action(s). Qualified representatives from engineering, quality assurance, and construction will review the NCR and either accept or reject the recommended corrective action or disposition. The NCR will remain open until the nonconforming condition has been satisfactorily resolved and verified by the QC inspection staff and the PQCM.

7.1 IDENTIFICATION OF NONCONFORMING ITEMS

Items identified as nonconforming will be documented on an NCR that will include the following information:

- Description of nonconforming item or activity
- Referenced criteria
- Recommended disposition and corrective action
- Affected organization

7.2 CONTROL OF NONCONFORMING ITEMS

Nonconforming items will be controlled to prevent inadvertent use. All items noted as nonconforming will be clearly identified and segregated from acceptable items, when practicable.

7.3 CORRECTIVE ACTION MONITORING

The PQCM shall monitor corrective actions for proper implementation, acceptance, and closure.

7.4 DISPOSITION

The disposition of NCRs will include the necessary actions required to bring the nonconforming condition to an acceptable condition and may include reworking, replacing, retesting, or reinspecting. Implementation of the disposition may be done in accordance with the original procedural requirements, a specific instruction, an FCR, or a Design Change Notice (DCN).

7.4.1 Field Change Requests

Site personnel shall document changes to the approved plans in the field through the FCR form. At a minimum, the following information will be documented on the FCR form:

- Project name
- CTO number
- FCR number
- Documents to which a change is requested (including revision number if applicable)
- Description of the item or condition for which the change is requested
- Reason for the change
- Recommended disposition
- Cost and schedule implication of the change, if any
- Approval of disciplines if changes involve risk-sensitive items in that discipline
- Approval of the PjM, Site Superintendent, Program Environmental Safety Manager, and QCM

7.4.2 Design Change Notices (DCN)

Site personnel shall document changes to approved design documents on a DCN form. At a minimum, the following information will be documented on a DCN form:

- Project name
- CTO number
- DCN number
- Documents to which a change is requested (including revision number, if applicable)
- Description of the item or condition for which the change is requested
- Reason for the change
- Approval of the QCM and PjM

7.5 TRACKING LOGS

NCRs, FCRs, and DCNs will be tracked through to closure on logs that will contain the following information:

- A sequential document number (e.g., FCR-XX-001, NCR-XX-001, etc.)
- Date identified or created
- Description of item, activity or condition
- Affected location
- Date of closure or approval

8.0 DOCUMENT CONTROL, RECORDS MANAGEMENT AND PROJECT SUBMITTALS

8.1 DOCUMENT CONTROL

Document control is the process of controlling a document so that it is distributed and used at the appropriate location in the most current form. It is the responsibility of the PjM to ensure that the most current plans, procedures, specifications, and drawings are being used on the project.

The requirements described in the following sections will be executed in addition to the implementing procedures.

Document controls include identification of documents to be controlled and their specified distribution, and identification of assignment of responsibility for preparing, reviewing, approving, and issuing documents.

The preparation, issuance, and revision(s) of documents that specify quality requirements or prescribe activities affecting quality will be controlled to ensure that current and approved documents are being used.

Reports, technical plans, design documents, and other technical deliverables are subject to TtEC's internal review and approval process. A record of review comments will be documented in one of the following four ways:

- A memorandum from the reviewer to the author, with itemized comments, and a corresponding response memorandum from the author to the reviewer
- A marked-up copy of the document with the reviewer's comments and signature and the author's written response on the same copy
- A completed comment resolution sheet, consistency review checklist, and comment resolution sheet
- Appropriate approval boxes on forms, graphics, and printouts that have been initialed and dated

Only after the approved signatures have been obtained on a sign-off form can a document be copied and bound for delivery to the DON. The original sign-off form is kept with the original document.

Design review procedures will be consistent with guidelines contained in TtEC procedures, Design Classification Levels, and Project Engineering Reviews.

Drawings, specifications, and other design documents will be distributed to all involved disciplines for review in order to ensure that the design criteria have been properly implemented. Comments and clarification will be provided to the Lead Design Engineer for review and revision of the design as appropriate.

8.2 RECORDS MANAGEMENT

The PjM is responsible for establishing a records management system for each CTO to ensure clarity, completeness, retrievability, and conformance to contract requirements. Records of activities will be transmitted to the DON as requested and required by the contract. The originator of each record is responsible for the legibility, correctness, and completeness of the record. Records management includes controlling documents affecting quality, as well as report deliverables. These documents will contain a unique document control number to ensure traceability and accountability. Records shall be stored in a controlled area for the duration of the project and will be archived until files are requested by the DON, as specified in contract requirements. The PjM is responsible for ensuring document security.

Records to be controlled by this PCQC Plan include only those that furnish documentary evidence of the quality of items, services, environmental processes, and engineered systems. The term record(s) used throughout this PCQC Plan denotes QC records.

Records are specified, prepared, and maintained by the management of the organizations that generate the records. When records are controlled by organizations other than those generating the records, the delegation of that authority will be defined in implementing procedures or CTO-specific plans.

Administration of the records system consists of identification, generation, validation, indexing, distribution, classification, retention, and record correction requirements.

The records receipt control system involves receipt responsibilities, transmittal/receipt control, and record status.

Records storage requirements include preservation and safekeeping for a variety of temporary and permanent facilities. The storage system incorporates provisions for retrieval of information by designated personnel in accordance with planned retrieval intervals based upon the record type and need.

Disposition of records requires authorization by the DON, PjM, or designated senior management.

8.3 PROJECT SUBMITTALS

Task-specific documents will be issued as required by each individual CTO. The Submittal Register, Contractor Production Report, Daily CQC Report, and Rework Items List are incorporated into this PCQC Plan in Attachment 1. Required QC records may include, but are not limited to, the following documents:

8.3.1 Submittal Register

The Submittal Register will be maintained current by TtEC at the job site and will include the status of all submittals required by the contract. All submittals will be reviewed for compliance with contract requirements, independent of the PQCM, prior to approval by the PQCM. The length of time for submission is specified in each CTO.

8.3.2 Contractor Production Report

The Contractor Production Report will be submitted by TtEC to the NTR identifying prime and subcontractor workforce and their labor hours, location, description of work performed, weather conditions and temperatures, list of job safety actions taken and safety inspections conducted, equipment left on the job site, equipment/materials received, and if applicable, submittal status, noncompliance notices received, errors and/or omissions in plans and specifications, visitors to the job site, and any other pertinent information. The Contractor Production Report will be prepared and submitted daily to the PQCM, and will be included as an attachment to the Daily CQC Report. The Contractor Production Report will be signed by the Site Superintendent.

8.3.3 Contractor Quality Control Report

The Daily CQC Report will be submitted by the PQCM to the NTR recording inspection and/or testing performed, identification and location of each definable feature of work and its current phase (preparatory, initial, follow-up) of completion; results of inspections/testing, location, and description of deficiencies; deficiencies corrected as of the date of the report; and status of any rework items. The report will include a statement of certification. This required certification will be signed and dated by the authorized PQCM. The Daily CQC Report will be submitted every day work is performed, material delivered, direction is pending, or a labor force is present, for every 7 consecutive calendar days of no work, and in the last day of the no-work period. Every calendar day throughout the life of the CTO will be accounted for. The Daily CQC Report will be provided to the NTR for review and signature by 10:00 a.m. on the working day following the day the work was performed, or as agreed to by the NTR.

8.3.4 Monthly Rework Items List

The Monthly Rework Items List will be used by TtEC to track nonconforming work. The Monthly Rework Items List will be submitted to the NTR the last working day of the month. The PQCM will update the list, stating specifically what is nonconforming, the date the nonconforming work was originally discovered, and the date the work was corrected. The PQCM will not allow task personnel to add to or build upon nonconforming work unless, in the opinion of the NTR, correction can be made without disturbing the continuing work.

8.3.5 As-built Records

As-built records will be controlled by the PQCM to ensure that drawings are kept current on a daily basis. The as-built records will be marked to show any deviations from the contract drawings, including buried or concealed structures and utilities revealed during the course of site work. The PQCM or designated person assigned to inspect that particular portion of work shall initial each variation or revision. These records will be available for review by the NTR at all times. The PQCM will, upon completion of site work, certify the accuracy of the as-built record drawings, and submit them to the Contracting Officer or designated representative.

8.3.6 Test Plan and Log

The Test Plan and Log will be completed to summarize the results of various QC tests performed, in compliance with the specific provisions of individual CTOs. The report will be updated after each test is conducted, and will be attached to the last Daily CQC Report of each month.

8.3.7 Completion Certification

The Completion Certification is a certificate signed by the PQCM, PjM, and QCM to indicate technical completion of each CTO prior to final DON inspection and acceptance. This document certifies that all work has been completed, inspected, tested, and is in compliance with the contract. The completion certification will be forwarded to the DON prior to administrative closeout.

8.3.8 Test Reports

Test laboratory documents and summary reports will be provided to the Contracting Officer via the RPM, as required by the provisions of individual CTOs.

Additional records may be required on a CTO-specific basis. Certain special inspection and documentation requirements may be contained in the specification sections of individual CTOs. A record of these requirements shall be included in the Submittal Register and/or test plan and the results attached to the Daily CQC Report, and submitted to the DON for record purposes on an "as occurred" basis, unless otherwise indicated. Each report will be signed by both the PQCM and designated personnel who witnessed the test or inspection, certifying compliance with the specific contract requirement.

9.0 REFERENCES

Department of Defense (DoD), Department of Energy, Nuclear Regulatory Commission (NRC), and U.S. Environmental Protection Agency (EPA). 2000. *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM). *NUREG-1575*. Revision 1. August.

Naval Sea Systems Command. 2004. *Final Historical Radiological Assessment, Volume II.* August 31.

Tetra Tech FW, Inc. (TtFW). 2004a. *Contractor Quality Control Program Plan.* April 27.

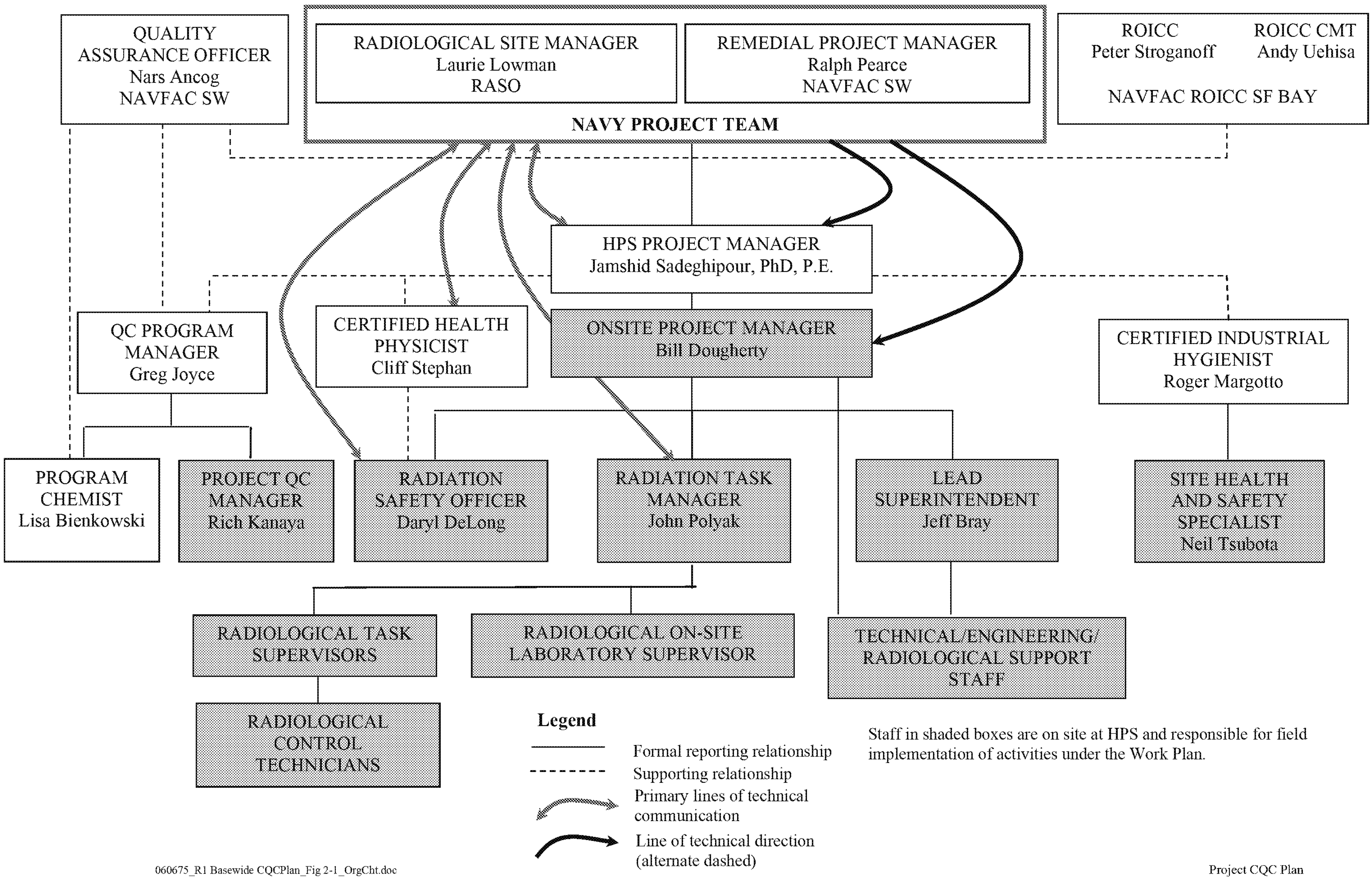
____________________. 2004b. *Final Base-wide Health and Safety Plan*. Hunters Point Shipyard, San Francisco, California. April 24.

United States Army Corps of Engineers (USACE). 2003. *Safety – Safety and Health Requirements*. EM 385-1-1. November 3.

FIGURES

FIGURE B.2-1

PROJECT ORGANIZATION CHART



Staff in shaded boxes are on site at HPS and responsible for field implementation of activities under the Work Plan.

ATTACHMENT 1

EXAMPLE CONTRACTOR QUALITY CONTROL FORMS

Preparatory Phase Checklist

Initial Phase Checklist

Contractor Quality Control Report

Contractor Production Report

Monthly Rework Items List

Field Change Request Form

Nonconformance Report

Nonconformance Report Log

Catalog Cut/Shop Drawing Transmittal and Approval

Deficiency Notice

Submittal Register

Testing Plan and Log

Design Change Notice

PREPARATORY PHASE CHECKLIST

(CONTINUED ON SECOND PAGE)

CONTRACT NO	DEFINABLE FEATURE OF WORK	SPEC SECTION	DATE
		SCHEDULE ACT NO.	INDEX #

PERSONNEL PRESENT

GOVERNMENT REP NOTIFIED _____ HOURS IN ADVANCE: YES ☐ NO ☐

NAME	POSITION	COMPANY/GOVERNMENT

SUBMITTALS

REVIEW SUBMITTALS AND/OR SUBMITTAL REGISTER. HAVE ALL SUBMITTALS BEEN APPROVED? YES ☐ NO ☐

IF NO, WHAT ITEMS HAVE NOT BEEN SUBMITTED? ____________

ARE ALL MATERIALS ON HAND? YES ☐ NO ☐

IF NO, WHAT ITEMS ARE MISSING? ____________

CHECK APPROVED SUBMITTALS AGAINST DELIVERED MATERIAL. (THIS SHOULD BE DONE AS MATERIAL ARRIVES.)

COMMENTS: ____________

MATERIAL STORAGE

ARE MATERIALS STORED PROPERLY? YES ☐ NO ☐

IF NO, WHAT ACTION IS TAKEN? ____________

SPECIFICATIONS

REVIEW EACH PARAGRAPH OF SPECIFICATIONS. ____________

DISCUSS PROCEDURE FOR ACCOMPLISHING THE WORK. ____________

CLARIFY ANY DIFFERENCES. ____________

PRELIMINARY WORK & PERMITS

ENSURE PRELIMINARY WORK IS CORRECT AND PERMITS ARE ON FILE.

IF NOT, WHAT ACTION IS TAKEN? ____________

TESTING	IDENTIFY TEST TO BE PERFORMED, FREQUENCY, AND BY WHOM.
	WHEN REQUIRED?
	WHERE REQUIRED?
	REVIEW TESTING PLAN.
	HAS TEST FACILITIES BEEN APPROVED?
SAFETY	ACTIVITY HAZARD ANALYSIS APPROVED? YES ☐ NO ☐
	REVIEW APPLICABLE PORTION OF EM 385-1-1.
MEETING COMMENTS	NAVY/ROICC COMMENTS DURING MEETING.
OTHER ITEMS OR REMARKS	OTHER ITEMS OR REMARKS:

QC MANAGER DATE

INITIAL PHASE CHECKLIST

		SPEC SECTION	DATE
CONTRACT NO	DEFINABLE FEATURE OF WORK	SCHEDULE ACT NO.	INDEX #

PERSONNEL PRESENT

GOVERNMENT REP NOTIFIED _____ HOURS IN ADVANCE: YES ☐ NO ☐

NAME	POSITION	COMPANY/GOVERNMENT

PROCEDURE COMPLIANCE

IDENTIFIY FULL COMPLIANCE WITH PROCEDURES IDENTIFIED AT PREPARATORY. COORDINATE PLANS, SPECIFICATIONS, AND SUBMITTALS.

COMMENTS: ______________________________

PRELIMINARY WORK

ENSURE PRELIMINARY WORK IS COMPLETE AND CORRECT. IF NOT, WHAT ACTION IS TAKEN?

WORKMANSHIP

ESTABLISH LEVEL OF WORKMANSHIP.

WHERE IS WORK LOCATED? ______________________________

IS SAMPLE PANEL REQUIRED? YES ☐ NO ☐

WILL THE INIITAL WORK BE CONSIDERED AS A SAMPLE? YES ☐ NO ☐

(IF YES, MAINTAIN IN PRESENT CONDITION AS LONG AS POSSIBLE AND DESCRIBE LOCATION OF SAMPLE) ______________________________

RESOLUTION

RESOLVE ANY DIFFERENCES.

COMMENTS: ______________________________

CHECK SAFETY

REVIEW JOB CONDITIONS USING EM 385-1-1 AND JOB HAZARD ANALYSIS

COMMENTS: ______________________________

OTHER

OTHER ITEMS OR REMARKS

____

QC MANAGER DATE

CONTRACTOR QUALITY CONTROL REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE

REPORT NO

PHASE	CONTRACT NO:	CONTRACT TITLE:

PREPARATORY

WAS PREPARATORY PHASE WORK PREFORMED TODAY? YES ☐ NO ☐

IF YES, FILL OUT AND ATTACH SUPPLEMENTAL PREPARATORY PHASE CHECKLIST.

Schedule Activity No.	Definable Feature of Work;	Index #

INITIAL

WAS INITIAL PHASE WORK PREFORMED TODAY? YES ☐ NO☐

IF YES, FILL OUT AND ATTACH SUPPLEMENTAL INITIAL PHASE CHECKLIST. N/A

Schedule Activity No.	Definable Feature of Work	Index #

FOLLOW-UP

WORK COMPLIES WITH CONTRACT AS APPROVED DURING INITIAL PHASE? YES ☐ NO ☐

WORK COMPLIES WITH SAFETY REQUIREMENTS? YES ☐ NO ☐

Schedule Activity No.	Description of Work, Testing Performed & By Whom, Definable Feature of Work, Specification Section, Location and List of Personnel Present

REWORK ITEMS IDENTIFIED TODAY (NOT CORRECTED BY CLOSE OF BUSINESS)		REWORK ITEMS CORRECTED TODAY (FROM REWORK ITEMS LIST)	
Schedule Activity No.	Description:	Schedule Activity No.	Description:

REMARKS (Also Explain Any Follow-Up Phase Checklist Item From Above That Was Answered "NO"), Manuf. Rep On-Site, etc.

Schedule Activity No.	Description:

AUTHORIZED QC MANAGER ON-SITE DATE

GOVERNMENT QUALITY ASSURANCE REPORT

DATE

QUALITY ASSURANCE REPRESENTATIVE'S REMARKS AND/OR EXCEPTIONS TO THE REPORT

Schedule Activity No.	Description

GOVERNMENT QUALITY ASSURANCE MANAGER DATE

CONTRACTOR PRODUCTION REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

CONTRACT NO	TITLE AND LOCATION		DATE
			REPORT NO
CONTRACTOR		SUPERINTENDENT	
AM WEATHER	PM WEATHER	MAX TEMP (F)	MIN TEMP (F)

WORK PERFORMED TODAY

WORK LOCATION AND DESCRIPTION	EMPLOYER	NUMBER	TRADE	HRS

JOB SAFETY

WAS A JOB SAFETY MEETING HELD THIS DATE? (If YES attach copy of the meeting minutes)	☐ YES	☐ NO	TOTAL WORK HOURS ON JOB SITE, THIS DATE, INCL CON'T SHEETS	
WERE THERE ANY LOST TIME ACCIDENTS THIS DATE? (If YES attach copy of completed OSHA report)	☐ YES	☐ NO	CUMULATIVE TOTAL OF WORK HOURS FROM PREVIOUS REPORT	
WAS CRANE/MANLIFT/TRENCHING/SCAFFOLD/HV ELEC/HIGH WORK/ HAZMAT WORK DONE? (If YES attach statement or checklist showing inspection performed.)	☐ YES	☐ NO	TOTAL WORK HOURS FROM START OF CONSTRUCTION	
WAS HAZARDOUS MATERIAL/WASTE RELEASED INTO THE ENVIRONMENT? (If YES attach description of incident and proposed action.)	☐ YES	☐ NO		

LIST SAFETY ACTIONS TAKEN TODAY/SAFETY INSPECTIONS CONDUCTED ☐ SAFETY REQUIREMENTS HAVE BEEN MET.

EQUIPMENT/MATERIAL RECEIVED TODAY TO BE INCORPORATED IN JOB (INDICATE SCHEDULE ACTIVITY NUMBER)

Submittal #	Description of Equipment/Material Received

CONSTRUCTION AND PLANT EQUIPMENT ON JOB SITE TODAY. INDICATE HOURS USED AND SCHEDULE ACTIVITY NUMBER.

Owner	Description of Construction Equipment Used Today (incl Make and Model)	Arrival	Off Rent Date	Actual Demob Date	Hours Idle	Hours Used	Reason for Idle

REMARKS

CONTRACTOR/SUPERINTENDENT

DATE

ED_006787_00011211-00460

MONTHLY REWORK ITEMS LIST

Contract No. CTO No. Project :
Contractor: Date:

NUMBER	DATE IDENTIFIED	DESCRIPTION	CONTRACT REQUIREMENT (Spec. Section and Par. No., Drawing No. and Detail No., etc.)	ACTION TAKEN BY QC MANAGER	RESOLUTION	DATE COMPLETED

FIELD CHANGE REQUEST FORM

Contract No.	CTO No.	Field Change Request Form No. FCR-
Location		Date

RE: Drawing No. ____________________ Title ____________________

Specification Section ____________________ Title ____________________

Other ____________________

Description (items involved, submit sketch, if applicable)

Reason for Change

Recommended Disposition (submit sketch, if applicable)

FIELD CHANGE REQUEST FORM

Contract No.	CTO No.	Field Change Request Form No. FCRF-

Additional Details

Will this change result in a contract cost or time change? ☐ Yes ☐ No

Estimate of contract cost or time charge (if any) ____________________

Preparer (signature)	Date	Preparer's Title	Site Superintendent (Signature)	Date

Disposition

☐ Approved.

☐ Not approved (give reason). ____________________

TtEC Engineer (signature) (if engineering related) ☐ Comments (attached) ☐ No Comments	Date	TtEC Project Manager (signature) ☐ Comments (attached) ☐ No Comments	Date
TtEC PESM (signature) (if health and safety related) ☐ Comments (attached) ☐ No Comments	Date	TtEC Scientist (signature) (if science related) ☐ Comments (attached) ☐ No Comments	Date
TtEC QC Program Manager (signature) ☐ Comments (attached) ☐ No Comments	Date		

Distribution: Original to Project File, Copy to Site File,
Project Manager, DON RPM, DON ROICC, PQCM, QCM, Site Superintendent

NONCONFORMANCE REPORT

	Report No.
Client or Project:	Drawing No./Spec. No.
Supplier, Construction QC or Contractor	P.O. No.
Description of Component, Part or System	

I. Description of Nonconformance *(Items involved, specification, code or standard to which items do not comply, submit sketch if applicable)*		
Name and Signature of Person Reporting Nonconformance	Title/Company	Date
II. Recommended Disposition *(Submit sketch, if applicable)*		
Name and Signature of Person Recommending Disposition	Title/Company	Date
III. Evaluation of Disposition by Tetra Tech EC, Inc., Reason for Disposition		
IV. Corrective Action ☐ Required	☐ Not Required	

V. ☐ Engineering	☐ QA/QC	☐ Construction	☐ Other
Name *(Signature)*	Name *(Signature)*	Name *(Signature)*	Name *(Signature)*
Date	Date	Date	Date
☐ Accepted ☐ Rejected ☐ Accepted with Comments	☐ Accepted ☐ Rejected ☐ Accepted with Comments	☐ Accepted ☐ Rejected ☐ Accepted with Comments	☐ Accepted ☐ Rejected ☐ Accepted with Comments

VI. Verification of Disposition ☐ Required		☐ Not Required	
By	Signature	Title	Date

NONCONFORMANCE REPORT LOG

PROJECT TITLE: ______________________________

PROJECT LOCATION: ______________________________

CONTRACTOR: ______________________________

				DATE					
NCR NO.	HOLD TAG NO.	DESCRITION OF CONDITIONS/ ITEM AFFECTED	LOCATION	VALIDATION	DISPOSITION/ APPROVAL	RE-INSPECTION	CLOSURE	HOLD TAG REMOVAL	REMARKS

See instructions on reverse
No carbon paper is required to complete this form
No transmittal letter required

CATALOG CUT/SHOP DRAWING TRANSMITTAL AND APPROVAL
SOUTHWESTNAVFACENGCOM 4355 / 2 (10-89)

SUBMITTAL NO.	CQC CLAUSE ☐ IS APPLICABLE ☐ IS NOT APPLICABLE	
REFERENCES TO USE WHEN CQC CLAUSE IS APPLICABLE	**PART I – FOR CONTRACTOR USE**	REFERENCES TO USE WHEN CQC CLAUSE IS NOT APPLICABLE
(A) ROICC/REICC	FROM (*Contractor*) / TO (A)	(A) DESIGNER
	CONTRACT NO. / CONTRACT TITLE	
(B) *(Check one)* ☐ RECORD ☐ APPROVAL	THE FOLLOWING ITEM IS SUBMITTED FOR (B) PER SPECIFICATION SECTION NUMBER	(B) APPROVAL
	CERTIFICATION (This form shall not be used to forward proposed substitutions) IT IS HEREBY CERTIFIED THAT THE ☐ EQUIPMENT ☐ MATERIAL SHOWN AND MARKED IN THIS SUBMITTAL IS THAT PROPOSED TO BE INCORPORATED INTO CONTRACT N68711–98–D–5713, CTO 0011 IS IN COMPLIANCE WITH THE CONTRACT DRAWINGS AND SPECIFICATIONS AND CAN BE INSTALLED IN THE ALLOCATED SPACES.	
(C) AUTHORIZED CONTRACTOR QUALITY CONTROL REPRESENTATIVE	CERTIFIED BY (C) / DATE	(C) PERSON DESIGNATED BY CONTRACTOR AS HAVING AUTHORITY TO SIGN CERTIFICATION
	PART II – FOR DESIGNER USE	
	FROM (*Designer*) / TO (ROICC/REICC)	
(D) CURSORY REVIEW REQUIRED ON RECORD COMES – REPLY TO ROICC ONLY IF APPROPRIATE. DETAILED REVIEW REQUIRED ON SUBMITTALS FOR GOVERNMENT APPROVAL STAMP AND MARK EACH COPY AS APPROPRIATE.	THIS SUBMITTAL HAS BEEN REVIEWED (D). THE FOLLOWING RECOMMENDATION IS MADE:	(D) DETAILED REVIEW REQUIRED. STAMP AND MARK EACH COPY AS APPROPRIATE
	SIGNATURE / DATE	
	PART III – FOR ROICC/REICC USE	
(E) DESIGNER *(Copy to ROICC)*	FROM (*ROICC/REICC*) / TO (E)	(E) CONTRACTOR *(Copy to ROICC)*
	ENCLOSURES ARE RETURNED WITH THE FOLLOWING COMMENTS:	
	SIGNATURE / DATE	

INSTRUCTIONS

Enter submittal number.
Check applicable CQC clause.

CONSTRUCTION CONTRACTOR – PART I

From: Construction contractor's name and address.
To: Designer's name and address or ROICC/REICC as applicable.

Enter contract number.

Enter title of contract and location.

Describe item being transmitted. <u>A separate form must be used for each set of catalog cuts or shop drawings</u>. Include name of manufacturer, catalog sheets, drawing no., name of item, and number of copies forwarded.

Check submittal for record or approval purposes.

Type date and name.

Sign original and one.

Distribution (as applicable to CQC clause):

Send to designer: original and four transmittal forms with the seven copies of catalog cuts or shop drawings. When factory inspection is required, send eight copies.

Send to ROICC/REICC: one carbon copy of form.

Send to ROICC/REICC (CQC): Original and three copies of catalog cuts or shop design.

Retain one copy for your files.

DESIGNER (A&E CONTRACTOR, SOUTHWESTNAVFACENGCOM) OR OICC RESPONSIBLE FOR DESIGN – PART II

From: Designer's name and address.
To: ROICC/REICC and address.

Enter recommended action (i.e., approval recommended or disapproved, with appropriate comments).

Type date and name.

Sign original and one.

Distribution:

Send to ROICC/REICC: original and three copies with <u>six</u> (or seven when factor inspection is required) copies of catalog cuts or shop drawings.

Retain one copy of form and one copy of cuts or drawings for your files.

ROICC OR REICC – PART III

From: ROICC or REICC and address.
To: Construction contractor's name and address.

Enter action taken (i.e., approved subject to, etc.).

Type date and name.

Sign original and one.

Distribution:

Send to construction contractor: original with <u>three</u> copies of cuts or drawings

Send to OICC one carbon copy of form with one copy of cut or drawings.

Retain two copies of form and two copies of cuts or drawings: one for field use and one for ROICC/REICC file.

NOTE: When factory inspection is required, forward one approved copy of cuts or drawings to the OICC, Construction Division. Cover transmittal should state the information is forwarded for factory inspection.

DEFICIENCY NOTICE

	DEFICIENCY NOTICE NO.: ______ **TASK ORDER:** ______ **DATE:** ______ **LOCATION:** ______

DESCRIPTION OF DEFICIENT ITEM OR SPEC/DRAWING/PLAN OR PROCEDURE	

I. DESCRIPTION OF DEFICIENCY

QC Notification required prior to initiating Corrective Action? Yes ______ No ______

Deficiency Notice prepared by: ______ Approved by: ______

II. CORRECTIVE ACTION

______ Organization ______ Signature ______ Date

III. RE-INSPECTION RESULTS

______ Accepted

______ Rejected

Reissue Under: D.N. No.: ______ NCR No.: ______

______ PQCM ______ Date

IV. DISTRIBUTION

Responsible Organization	______	QC Program Manager	______
Site Superintendent	______	PjM	______
Program Manager	______		

SUBMITTAL REGISTER

TITLE AND LOCATION			CONTRACTOR											CONTRACT NO.	
			CONTRACTOR SCHEDULE DATES				CONTRACTOR ACTION			APPROVING AUTHORITY					
TRANSMITTAL NO	SPECIFICATION PARAGRAPH NO.	DESCRIPTION ITEM SUBMITTED	CLASSIFICATION GOVT OR A/E REVIEWER	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)

Action Code: NR: Not Reviewed AN: Approved as Noted A: Approved RR: Disapproved; Revise and Resubmit

TESTING PLAN AND LOG

CONTRACT NUMBER			PROJECT TITLE AND LOCATION							CONTRACTOR Tetra Tech EC, Inc.		
SPECIFICATION SECTION AND PARAGRAPH NUMBER	ITEM OF WORK	TEST REQUIRED	ACCREDITED/ APPROVED LAB		SAMPLED BY	TESTED BY	LOCATION OF TEST		FREQUENCY	DATE COMPLETED	DATE FORWARDED TO CONTR. OFF.	REMARKS
			YES	NO			ON SITE	OFF SITE				

DESIGN CHANGE NOTICE

CTO # ________ DCN # ________ DATE________

LOCATION ________ NTR / RPM ________

Re: ________ Drawing No. ________ Title ________

________ Spec. Section ________ Title ________

________ Other ________ Title ________

1. Description of Change (Items involved, submit sketch, if applicable): **(Use continuation sheet if necessary)**

Engineering "HOLD" placed on all activities in area defined herein pending receipt of formally revised document(s) and / or
Released for construction basis of modifications prescribed by this

2. Reason for Change **(Use Continuation Sheet if**

____ Field Change Request (FCR ________)
____ Required Modifications to Drawings or
____ Other ________

Exhibits Attached

________ Copies of marked-up area of
________ Field Change Request (FCR ____)
________ Other (Describe)

3. COMMENTS

Originator ________ Date____

1) QC Program Manager	Date	2) Project Manager (Signature)	Date

Distribution:

Original to CTO File, Copy to Site
Signatories from above, Site Superintendent, PQCM, SHSS

APPENDIX C

STORMWATER POLLUTION PREVENTION PLAN

APPENDIX C

FINAL

STORMWATER POLLUTION PREVENTION PLAN
May 16, 2008

BASE-WIDE STORM DRAIN AND SANITARY SEWER REMOVAL HUNTERS POINT SHIPYARD SAN FRANCISCO, CALIFORNIA

DCN: FWSD-RAC-06-0675.R2

Prepared for:

Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

CONTRACT NO. N68711-98-D-5713
CTO NO. 0072

Prepared by:

TETRA TECH EC, INC.

1230 Columbia Street, Suite 500
San Diego, CA 92101

Tim Lai, P.E.
Civil Engineer

Bill Dougherty
Project Manager

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ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
BMP	Best Management Practice
BRAC PMO	Base Realignment and Closure Program Management Office
CA	construction activity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSO	Caretaker Site Office
DON	Department of the Navy
DWQ	Division of Water Quality
EPP	Environmental Protection Plan
ESC	erosion and sediment control
HDPE	high-density polyethylene
HPS	Hunters Point Shipyard
IR	Installation Restoration
LLMW	low-level mixed waste
LLRW	Low-Level Radioactive Waste
NAVFAC SW	Naval Facilities Engineering Command, Southwest
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
PPE	personal protective equipment
PVC	polyvinyl chloride
RAC	Remedial Action Contract
RCRA	Resource Conservation and Recovery Act
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager
RRO	radiological remedial objective
RWQCB	Regional Water Quality Control Board
SHSP	Site-specific Health and Safety Plan
SWM	surface water management
SWPPP	Stormwater Pollution Prevention Plan

ABBREVIATIONS AND ACRONYMS
(Continued)

TBD	to be determined
TSCA	Toxic Substances Control Act
TtEC	Tetra Tech EC, Inc.
WMP	Waste Management Plan

1.0 INTRODUCTION

This Stormwater Pollution Prevention Plan (SWPPP) presents the measures that will be implemented to minimize sediment and other pollutants in stormwater discharges during storm drain and sanitary sewer removal actions at Hunters Point Shipyard (HPS), San Francisco, California (Figure C.1-1). Tetra Tech EC, Inc. (TtEC) has been subcontracted by the Department of the Navy (DON) to develop the plans for these removal actions at HPS for the Base Realignment and Closure Program Management Office (BRAC PMO) West under Naval Facilities Engineering Command, Southwest (NAVFAC SW) Remedial Action Contract (RAC) No. N68711-98-D-5713. The DON is directing this removal action in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

This SWPPP has been prepared for the DON to comply with the substantive requirements of the National Pollutant Discharge Elimination System (NPDES) program, specifically the General Construction Activity Stormwater Permit program as set forth by the California Regional Water Quality Control Board (RWQCB) in August 1999, Resolution No. 99-08-Division of Water Quality (DWQ). Regulated sites, including "site grading over 1 acre," are generally required to develop a SWPPP, a Stormwater Monitoring Sampling and Reporting Program and to submit a Notice of Intent (NOI). However, because the storm drain and sanitary sewer removal action is an on-site response action defined by CERCLA, an NOI is not required to be submitted.

HPS has a general permit for stormwater discharges. TtEC shall conduct operations in accordance with this permit. The removal of the existing storm drain and sanitary sewer systems will change the existing drainage flows and outfalls throughout HPS. These changes will be reflected in the Parcel-specific Design Plans to the SWPPP. The SWPPP and design plans shall be approved prior to invasive work at the outfalls. Procedures described in the Parcel-specific Design Plans shall ensure that stormwater collected in the open excavations is properly managed and will not be discharged to the undisturbed storm sewers.

1.1 PURPOSE

The two major objectives for this SWPPP consist of: 1) helping identify the sources of sediment and other pollutants that may affect the quality of stormwater discharges, and 2) describing and ensuring the implementation of Best Management Practices (BMPs) to reduce sediment and other pollutants in stormwater discharges during construction activities. This SWPPP includes BMPs that address source reduction.

This SWPPP is to be used in conjunction with the Work Plan, which has been prepared to describe the scope of the removal action. The DON has initiated this removal action for the extraction of soils and piping systems containing any radioactive contaminants that may be present above the criteria established as part of the radiological remedial objectives (RROs). Soils will be surveyed and sources of elevated radiation will be collected, segregated, and stored in appropriate containers for proper disposal. The excavated area will be backfilled, compacted, and graded.

1.2 SCOPE

Elements of this SWPPP include:

- Site description (Section 2.0)
- BMPs to be implemented for construction activities (Section 3.0)
- BMPs to be implemented for erosion and sediment control (ESC) (Section 4.0)
- Non-stormwater management (Section 5.0)
- Waste management and disposal (Section 6.0)
- Implementation of other approved plans (Section 7.0)
- Post-construction controls, including a description of local post-construction ESC requirements (Section 8.0)
- Site inspections and monitoring (Section 9.0)
- Responsible personnel (Section 10.0)
- Personnel training (Section 11.0)
- Certification of compliance (Section 12.0)
- SWPPP review and modifications (Section 13.0)
- References (Section 14.0)

The BMPs presented in Attachment 1 provide the measures and controls necessary to mitigate potential pollutant sources. Supporting site-specific inspection and monitoring reporting forms are provided in Attachment 2.

The climate in the project area is Mediterranean (National Oceanic and Atmospheric Administration Division CA-04: Central Coast) with moderate year-round temperatures and a winter rainy season. The SWPPP drainage system in place during construction is designed to control greater than a 2-year, 6-hour rainfall event. The replacement site stormwater drainage controls will accommodate runoff flows from a 100-year, 6-hour rainfall event.

2.0 SITE DESCRIPTION

The following section describes the physical setting, including weather at the site, in addition to a brief discussion of construction activities and potential pollution sources.

2.1 SITE LOCATION

HPS is located on a long promontory in the southeastern part of San Francisco that extends east into San Francisco Bay. Presently, HPS encompasses approximately 848 acres, including approximately 416 acres on land. HPS was divided into six parcels, Parcels A through F. In November 2004, Parcel A was transferred to the City and County of San Francisco. In 2004, the DON subdivided Parcel E, creating Parcel E-2. The site is bounded on the west by the San Francisco Bay and to the north and east by relatively flat grassland.

2.2 CLIMATE AND PRECIPITATION

Since 1970, monthly average temperatures at HPS have exhibited a seasonal pattern ranging from an average low of 49 degrees Fahrenheit (°F) to an average high of 65°F.

The closest long-term precipitation gauge to HPS is located at San Francisco Airport, COOP ID 047769, 10.7 miles south of HPS. The average annual rainfall at that location had a mean of 20.12 inches per year (Table C.2-1). Most of this precipitation occurs during the months of November through March, while summers are relatively dry.

TABLE C.2-1

MEAN MONTHLY RAINFALL AMOUNTS
SAN FRANCISCO, CA
(inches)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
4.5	3.6	2.88	1.31	0.39	0.12	0.02	0.05	0.19	0.96	2.46	3.64

Annual Mean = 20.12 inches
Source: The Weather Channel, 2005 (www.weather.com)

2.3 EXISTING STORMWATER CONVEYANCE SYSTEM

The existing stormwater conveyance system is fully described in the Project Work Plan for Base-wide Storm Drain and Sanitary Sewer Removal (Work Plan).

2.4 CONSTRUCTION ACTIVITIES

The following is a general description of the construction activities and the stormwater management control system to be implemented.

Mobilization activities will include site preparation, moving equipment and materials to the site, establishing a laydown area, installing security fencing and stormwater runoff controls, and protection or proper abandonment of utilities within the excavation footprint. Vegetation will be cleared and grubbed as needed to facilitate excavation or stockpiling of materials. Existing topographical maps will be reviewed to establish surface water flow directions. A geophysical survey and utility clearance will be performed over the excavation site prior to performing intrusive work to identify existing subsurface utilities.

Prior to beginning the excavation, sandbag or straw bale berms will be installed downgradient and upgradient of any excavation where the runoff may lead to open storm drains or the Bay, as well as to prevent stormwater run-on from areas outside of the excavation. Any storm drains located within 50 feet of the excavations, and not a part of the removal action, will be surrounded with sandbags and the storm drain covered with filter fabric.

To protect areas along the waterfront, silt fencing may be used if no asphalt is present. Sandbags and/or straw bale berms will be used in asphalt areas, where silt fencing is not possible. If needed, sandbags will be placed in drainage control swales and at drainage control discharge points or areas with high probability of erosion. Stormwater coming into contact with the excavated areas will be collected to prevent any uncontrolled discharge into the Bay. Bias sampling will be conducted on collected water and will determine the method of disposal in accordance with the Waste Management Plan (WMP), Section 8.0 of the Work Plan.

To prevent rain from coming into contact with the stockpiled soil and to minimize wind dispersion of particulate matter, the stockpiles will be covered with a 10-mil liner and secured with sandbags at the end of each workday. Stockpiles or radioactively contaminated materials will be placed directly into shipping containers or secured and posted when not attended. The approach for remediating the site is to excavate soil to within 12 inches of the pipe or system component. These soils will be sampled for chemical contaminants when the excavation is in an Installation Restoration (IR) site. The 12 inches of soil surrounding the pipe or component will be removed and stockpiled separately. This soil will be surveyed and sampled. An in situ survey will be completed for the soils remaining after removal actions. Saturated materials will not be surveyed in situ. Sections of the stormwater and/or sewer lines will be excavated and soils stockpiled in approximately 100-foot sections.

Removed soil will, as necessary, be placed on dewatering pads, spread out in 12-inch lifts, and allowed to dewater. Stockpiles determined to contain Toxic Substances Control Act (TSCA), and

Resource Conservation and Recovery Act (RCRA) hazardous waste will be segregated if hazardous waste is identified during soil stockpile characterization activities.

Radioactively contaminated material (debris, excavated soils, including mixed wastes) exhibiting concentrations above the RROs will be processed as radioactive or mixed waste and separated out in clearly labeled containers. Radioactive and mixed waste will be properly stored on site pending packaging, transportation, and disposal by an Army contractor in compliance with the DON Low-level Radioactive Waste (LLRW) Disposal Program. Sampled and surveyed soils that do not exhibit radioactivity at concentrations greater than the RROs will be stockpiled and characterized for use as backfill.

Saturated soil conditions may exist and a dewatering pad may be required for soils excavated below the groundwater table to drain. The dewatering pad will be lined and bermed to capture any additional potential runoff water from the soils. In addition, if groundwater is present in the excavation, it may need to be pumped directly from the excavation to an approved storage container. To the extent practical, waters from known groundwater plume locations will be collected and stored separately from waters in non-IR site locations. Water from the dewatering pads and water pumped from the excavation to allow the removal actions to proceed will be collected and stored in containers. Bias sampling will be conducted on collected water and will determine the method of disposal in accordance with the WMP, Section 8.0 of the Work Plan.

Unsaturated excavated soils will be placed in stockpiles adjacent to the excavation area. The pads and stockpile area will be lined with high-density polyethylene (HDPE) or polyvinyl chloride (PVC) liner and bermed. At the end of each day, immediately prior to a forecasted rain event, or during high wind conditions, the soil stockpiles will be covered with a minimum 10-mil plastic sheeting/tarp and sandbagged to hold the sheeting in place. Completed stockpiles or stockpiles not in use will be covered at all times. Keeping the stockpiles covered, will prevent contaminants from entering stormwater. The berms will prevent sediment from migrating off site. If necessary, sediment deposits will be removed when they reach one-third of the berm height.

Following completion of excavation activities within an area, the excavation's bottom and sidewall will be sampled and analyzed for radiological purposes. If post-excavation screening of samples indicate concentrations greater than the RROs, additional excavation will be performed. Hazardous materials will be stored in a central area at least 100 feet from surface waters. Containers will be stored properly when not in use and will be placed in the appropriate storage cabinet or secondary containment structure to reduce the risks of fire and releases. In addition, refueling operations for construction equipment will be conducted in a designated area at least 100 feet from surface water bodies. Vehicle/equipment refueling operations will be supervised and appropriate spill control equipment will be available on site in the event of a release.

Proximal storm sewer inlets will also be covered during the refueling or hazardous material transfer operations.

To prevent bay waters from entering open storm drain lines, where removal is in progress, the outfall for the line will be plugged prior to beginning work. If the removal action is at an elevation not subject to storm or tidal influence, plugging the outfall will not be required. Additionally, sheet pile walls will be installed to prevent inflow from the Bay.

2.5 SITE HYDROLOGY

The construction drainage controls are based on a 2-year, 6-hour storm event retention and the 2-year peak flow rate (time of concentration: 10 minutes; rainfall intensity: 1 inch per hour). The estimated construction drainage control peak flow rate is 500 gallons per minute, per acre of drainage area.

2.6 CONSTRUCTION SEQUENCE

The construction sequence will be provided by TtEC and approved by the DON prior to beginning any excavation. The phased on-site construction activities will generally be as follows:

- **Pre-excavation Characterization Activities.** Contaminants of concern will be identified in the Parcel-specific Design Plan.
- **Construction Activities.** This stage includes excavation, screening of soil and debris for radiological material, stockpiling, waste characterization, and proper on-site storage of the impacted soils (pending disposal through the DON LLRW Disposal Program); and post-excavation sampling and backfilling, and compaction of the excavated area.
- **Site Restoration and Decontamination.** This stage includes decontamination of all project equipment; removal of wastewater, used personal protective equipment (PPE), and other wastes; followed by final grading of the area.

2.7 SOURCE IDENTIFICATION

2.7.1 Potential Pollutants During the Construction Phase

Hazardous materials used during construction will include gasoline, diesel fuel, motor oil, hydraulic fluid, and various lubricants. Fuel, oil, and lubricants will be stored in small quantities in vehicles or approved containers or storage cabinets. Acutely hazardous materials will not be used or stored on site during construction. There are no feasible alternatives to motor fuels and oils for operating construction equipment. Chemical contaminants from soils may potentially be present, and radiological contamination is expected. Radiological waste will be stored within secondary containment in a designated waste storage area. Soil will be stockpiled and appropriate BMPs implemented to prevent chemical or radiological contamination from contacting stormwater.

The most likely incidents to occur involving these hazardous materials would be associated with minor spills or drips. Impacts from such incidents will be mitigated by thoroughly cleaning up minor spills as soon as they occur. Aboveground storage tanks containing potentially contaminated water will be stored in a bermed area or double-walled tanks in case of leaks. Soil stockpiles will be covered as needed to prevent sediment erosion of contaminated soil through air or stormwater. An incident involving a service vehicle or refueling truck release would present the worst-case scenario for release of hazardous materials. In the case of a large spill of hazardous material, the area would be immediately bermed/contained followed by blocking the nearest path to the San Francisco Bay to prevent off-site release. The spill would be reviewed by the Site Superintendent to determine if the DON and regulatory agencies need to be notified. A large spill or release cleanup would most likely involve excavation and storage of the impacted soil and/or materials in drums or roll-off bins for off-site disposal or recycling. The method for off-site disposal or recycling selected will depend on how the waste is classified.

3.0 BMPs TO BE IMPLEMENTED FOR CONSTRUCTION ACTIVITIES

The following describes BMPs for construction activities that may cause pollution. Attachment 1 provides detailed construction requirements for the activities, and construction activity reference numbers (such as CA31) can be found in parentheses after the BMPs indicated below. Additional BMPs may be developed as necessary prior to each construction phase. The BMPs for construction activities that may pollute the stormwater focus on the following potential pollutant sources:

- Contaminated fine-grained soil (silt) from the excavation suspended in stormwater runoff
- Contamination of stormwater with radioactivity, metals, or other contaminants of concern
- Hazardous materials including fuel, oil, and lubricant spills
- Wind erosion of contaminated soil stockpiles built during construction
- Solid waste from construction activities

Good housekeeping and maintenance practices are key factors in reducing potential off-site migration of pollution. These practices shall include elimination of brush, litter, or other items including solid waste that may clog drainage devices and pathways or enter the stormwater flow within the excavation areas. The achievement of good housekeeping and maintenance at the site also requires employee participation and requires specific training and control systems. The following BMPs that will be implemented at the site are essential to maintaining site control of potential pollution sources.

3.1 SPILL PREVENTION AND CONTROL (CA12)

The work at the site will be conducted under specific procedures developed by TtEC, including a Site-Specific Health and Safety Plan (SHSP; developed under a separate cover), a WMP, and Environmental Protection Plan (EPP), which are part of the Work Plan. These documents will be maintained on site and outline the specific steps to be followed in the event of a spill or release.

3.2 SOLID WASTE MANAGEMENT (CA20)

All construction waste shall be disposed in dumpsters, roll-off bins, or other similarly approved containers in designated areas located throughout the site. Specific procedures to handle all types of waste expected at the site have been developed by TtEC and are included in the WMP (Section 7.0 of the Work Plan). The plan will be maintained at the site.

3.3 HAZARDOUS WASTE MANAGEMENT (CA21)

The potential hazardous waste at the site includes contaminated soils, fuel, oil, and lubricant spills or releases. Specific procedures to handle all types of waste expected at the site have been developed and are included in the WMP. The plan will be maintained at the site.

3.4 CONTAMINATED SOIL MANAGEMENT (CA22)

The excavation activities require the use of a dewatering pad, LLRW/low-level mixed waste (LLMW) staging area, as well as soil stockpiles for temporary storage of soils following excavation and prior to off-site disposal or use as backfill. The individual stockpile size will be determined by the size and depth of the excavation. Lined, bermed areas will be prepared, as described in Section 2.4. All stockpiles will be covered with 10-mil polyethylene sheeting and secured with sandbags to prevent wind erosion.

3.5 VEHICLE AND HEAVY EQUIPMENT FUELING (CA31)

3.5.1 Diesel Fuel

During construction activities, diesel fuel will be delivered and pumped directly into the equipment. Fueling will occur in designated areas, which are located away from drainage courses, to prevent the run-on of stormwater and the runoff of spills. If a spill occurs during on-site fueling activities, containment with an earth berm and/or excavation retention trap will be provided. The individual noting the spill will be responsible for contacting the Site Superintendent, who will notify the DON, who in turn is responsible for notifying regulatory authorities, as necessary, and managing the cleanup and removal of contaminated soils in accordance with regulations.

3.5.2 Gasoline and Vehicle-related Lubricants

Gasoline used for passenger vehicles and trucks will be obtained from filling stations off site. If any spill occurs during on-site fueling activities, the fueler will be responsible for contacting the Site Superintendent for cleanup and removal of contaminated soils.

All heavy equipment and vehicles are inspected at the beginning and end of each workday for oil and lubricant leaks. Leaking equipment will be repaired or removed from service and small leaks will be cleaned up immediately. Excessive greasing of components will be avoided and accumulated grease will be wiped off and the contaminated rags properly disposed of off site. All oil and lubricant supplies will be securely stored in drums or bins in the heavy equipment and maintenance area to prevent an uncontrolled discharge of spilled materials.

3.6 VEHICLE AND EQUIPMENT MAINTENANCE (CA32)

3.6.1 Heavy Equipment

Heavy equipment oil changes and maintenance may be performed on site. In the event that a spill associated with the heavy equipment (diesel, hydraulic fluid, or gas leak) occurs, containment will be provided, the Site Superintendent will be notified, the spill area will be excavated, and the material containerized and stored in the heavy equipment and maintenance area until proper off-site disposal.

3.6.2 Site Vehicles

Oil changes and maintenance for site vehicles will normally be performed by off-site mechanics.

3.7 EMPLOYEE/SUBCONTRACTOR TRAINING (CA40)

Primary work policies will be centered on requiring extensive training for employees and any subcontractor working on site. Each employee is required to be current with appropriate federal hazardous waste training requirements and other training programs, as defined in the SHSP prepared for the project. Each subcontractor will be required to attend daily safety meetings at the worksite, and each work phase is reviewed in project orientation meetings. These meetings discuss potential problems, including weather conditions, stormwater control, and a review of the response actions that will occur in the event of any particular spill or pollution situation.

4.0 BMPS TO BE IMPLEMENTED FOR EROSION AND SEDIMENT CONTROL

BMPs for ESC can be found in Attachment 1 and will be referenced and implemented (as necessary) during construction activities. ESC reference numbers (for example, ESC1) can be found in parentheses behind the BMPs indicated below.

4.1 CONSTRUCTION SEQUENCE / SCHEDULING (ESC1)

Grading construction will be sequenced to minimize the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking.

4.2 PRESERVATION OF EXISTING VEGETATION (ESC2)

Vegetation on the site will be preserved until the time that construction is expected to commence in that area. The preservation of existing vegetation shall be maximized where feasible. During construction, the limits of grading or disturbance will be clearly marked in order to segregate this area from areas of preserved vegetation.

4.3 SODDING OR OTHER GROUNDCOVER (ESC10)

Following final grade development, the site will be graded to match the grade specified in the Parcel-specific Design Plans. Additional temporary irrigation systems may be used in localized areas to promote rapid establishment of vegetation.

4.4 DUST CONTROLS (ESC21)

Dust control measures will be used to stabilize soil from wind erosion and to reduce dust generated from the following construction activities: clearing and grading activities, construction vehicle traffic on unpaved areas, and sediment tracking onto paved roads and areas of unstabilized soil stockpiles. Water trucks will be used for dust control. The source of water for the truck will be the city public water supply system. In addition to wet suppression (watering), preventative measures to be used for dust control include minimizing disturbed surface areas, limiting on-site vehicular traffic and speed, and controlling the number and activity of vehicles on the site at a given time.

4.5 SOIL STOCKPILE AREAS

During excavation, areas adjacent to the excavation may be used to stockpile soil. The soil will be stockpiled in a generally uncompacted condition and is, therefore, subject to erosion. In addressing stockpiling, BMPs will include diversion of drainage from the stockpile areas (ESC31), placement of additional sandbag desilting facilities (ESC52), silt fencing on the downgradient toe of stockpile slope (ESC50), and dust control (ESC21). In addition, large stockpiles will be sloped to encourage sheet flow and reduce the infiltration of rainwater. A 10-mil plastic cover will be deployed over the stockpiles at the end of each day and during rainy weather and/or windy conditions.

4.6 TEMPORARY SWALES (ESC31)

Swales may need to be cut to divert and control stormwater runoff during excavation. They can be used to divert sheet-flow over slopes, prevent run-on into open excavations or active construction zones, and control erosion along with transport of sediment.

4.7 SILT FENCE AND SANDBAGS (ESC50 AND 52)

Silt fencing may be used as a temporary sediment trapping/filtering device downgradient of all disturbed areas where sheet flow occurs. Silt fences will be installed on a level contour receiving no more than 1 acre of runoff per 100 linear feet or 0.5 cubic feet per second of concentrated flow draining to any point along the silt fence.

Sandbags will be used as a drainage diversion, sediment trapping, and stormwater velocity/erosion control. The sandbags will be installed on level contours receiving drainage areas up to 1 acre and in areas of concentrated flows and drainage courses.

Locations where silt fence and sandbags are to be used on site include:

- Sandbags and silt fencing around and along the downgradient toe of all soil stockpile areas
- Sandbags or silt fencing below cleared active construction areas
- Silt fencing along the downgradient toe of any work done on the shoreline or adjacent steeply sloping bank
- Sandbags in concentrated drainage flow course and as needed in areas downgradient of active work areas
- Sandbags as a diversion berm to run-on upgradient of active work areas and excavations

4.8 STRAW BALE FILTER BARRIER (ESC51)

Straw bale barriers consist of a series of secured, anchored bales placed to intercept and filter sediment-laden runoff from small areas of disturbed soil. Straw bales may be used on site in place of sandbags and silt fencing around stockpile areas and downgradient of any active areas where excess sediment may be expected. Straw bales may be required along the shoreline if the silt fencing does not provide adequate sediment filtration as determined by the field engineer.

5.0 NON-STORMWATER MANAGEMENT

Management of non-stormwater discharges will be implemented as part of the SWPPP. Potential non-stormwater discharges could include decontamination water, water generated during dewatering of pads, and groundwater from excavations. Each of these potential non-storm water discharges will be managed as described in Section 2.4 in order to prevent unintended releases.

Weekly inspections of the grading, vegetative cover, roads, and stormwater/erosion control structures (including secondary containment structures) will be conducted in addition to wet/dry season observations. Any authorized or unauthorized non-stormwater discharges, if observed, will be documented on the site inspection and monitoring forms in Attachment 2 of this SWPPP.

6.0 WASTE MANAGEMENT AND DISPOSAL

Residuals and wastes are generated by construction and site operation activities. Waste management involves the following four steps:

1. Characterization
2. Handling and storage
3. Transportation
4. Disposal or recycling as appropriate

The WMP, located in Section 8.0 of the Work Plan, provides detailed information on the above steps. The most important step with regards to maintaining compliance with the SWPPP is handling and storage. In order to reduce the potential for and severity of hazardous material spills, all materials and wastes will be stored within lined secondary containment. Portable spill pallets may be used for larger containers such as drums.

6.1 SPILL RESPONSE

If a spill, including a BMP failure, is discovered, it must be immediately contained, cleaned up, and the source of the leak repaired. The Project Manager, DON Remedial Project Manager (RPM), Resident Officer in Charge of Construction (ROICC), and Caretaker Site Office (CSO) will be notified of all reportable spills and releases. DON representatives will be advised to notify the RWQCB within 24 hours of the spill or leak. The Environmental and Safety Quality Scientist will determine what additional BMPs will need to be implemented to prevent future spills. If a spill occurs and threatens to contaminate stormwater generated at the site, monitoring and sampling must be conducted as described in Section 9.0.

7.0 IMPLEMENTATION OF OTHER APPROVED PLANS

Several site-specific management plans approved by TtEC and the DON have been implemented to provide a framework by which the construction and site operations are executed. These plans describe the methods that will be used to execute, integrate, and coordinate emergency response procedures, control quality, address safety and health, and generally perform the work in a sound manner. These plans include, but are not limited to, the following:

- Work Plan
- WMP (Section 8.0 of the Work Plan)
- EPP (Section 9.0 of the Work Plan)
- Sampling and Analysis Plan (Appendix A of the Work Plan)
- Project Contractor Quality Control Plan (Appendix B of the Work Plan)
- SWPPP (Appendix C of the Work Plan)

8.0 POST-CONSTRUCTION CONTROLS

This SWPPP provides general descriptions of the post-construction surface water management (SWM) system. The SWM system includes the following components:

- General grading with positive slopes
- Drainage pathways with terrace drainage controls
- Protective discharge control point
- Vegetative erosion control cover

Additional details on post-construction controls are located in Section 2.4 and will be further defined in the Parcel-specific Design Plans.

9.0 SITE INSPECTIONS AND MONITORING

All stormwater pollution prevention measures and BMPs will be inspected prior to the rainy season and before (prediction of) and following (measurement of) each rain event of 0.25 inches per 24 hours or more. This inspection will allow for evaluation of the BMPs implemented to prevent the release of potential pollutants. Inspections will be performed during construction activities by trained personnel, and the appropriate forms will be filled out. These forms are provided in Attachment 2 of this SWPPP. Inspections will include the date of the inspection, the individual(s) who performed the inspection, and the observations. Any BMP inadequacies shall be recorded and modified and upgraded or repaired as soon as possible. All completed inspection forms shall be retained at the field office for a period of at least 3 years.

On April 26, 2001, the State Water Resources Control Board adopted Resolution No. 2001-046, modifying the General Construction Stormwater Permit to develop a sampling and analysis procedure for construction activities discharging into water bodies listed for sedimentation control. The project will not be discharging into affected water bodies; therefore, periodic sampling and analysis is not required as defined under Resolution No. 2001-046.

Water sampling will be conducted should visual monitoring indicate that there has been a breach, malfunction, leakage, or spill from a BMP, which could result in the discharge of pollutants from the site. If a point discharge were to occur as a result of a breach of berm along the site border during construction activities, the monitoring point would be designated as the point closest to where the breach occurred, if water is present at the time of observation. The shoreline is another susceptible location. Should a BMP near the shoreline fail, the monitoring/sampling point would be nearest to the point where the BMP failed.

10.0 RESPONSIBLE PERSONNEL

The individuals who comprise the Pollution Prevention Team and are responsible for implementing and making any necessary revisions to this SWPPP are the following personnel:

Name	Title	Responsibility
Greta Neuman	Environmental Compliance Manager	Preparation of SWPPP and selection of BMPs. Revisions to the SWPPP.
Jeff Bray	Site Superintendent	Implementation of construction SWPPP, maintaining inspection and monitoring records, reporting, and regulatory notification.
Larry Sexton	Project Quality Control Manager	Implementation of inspection and monitoring activities of the SWPPP and BMPs.

11.0 PERSONNEL TRAINING

All personnel involved with the ongoing monitoring and maintenance of the stormwater management system will attend a training class held by the Site Superintendent, or his designee, before beginning the soil excavation phase of construction. The Site Superintendent will maintain a file of the training documentation. The SWPPP will be reviewed as it relates to the various responsibilities for personnel implementation and awareness.

12.0 CERTIFICATION OF COMPLIANCE

TtEC and the subcontractors will implement and comply with the program set forth within this SWPPP. Within 30 days of noncompliance, TtEC and/or the subcontractors will notify the DON and correct or submit a schedule for necessary corrections. Written certification that the corrections were undertaken will be issued to the DON upon completion of the activities.

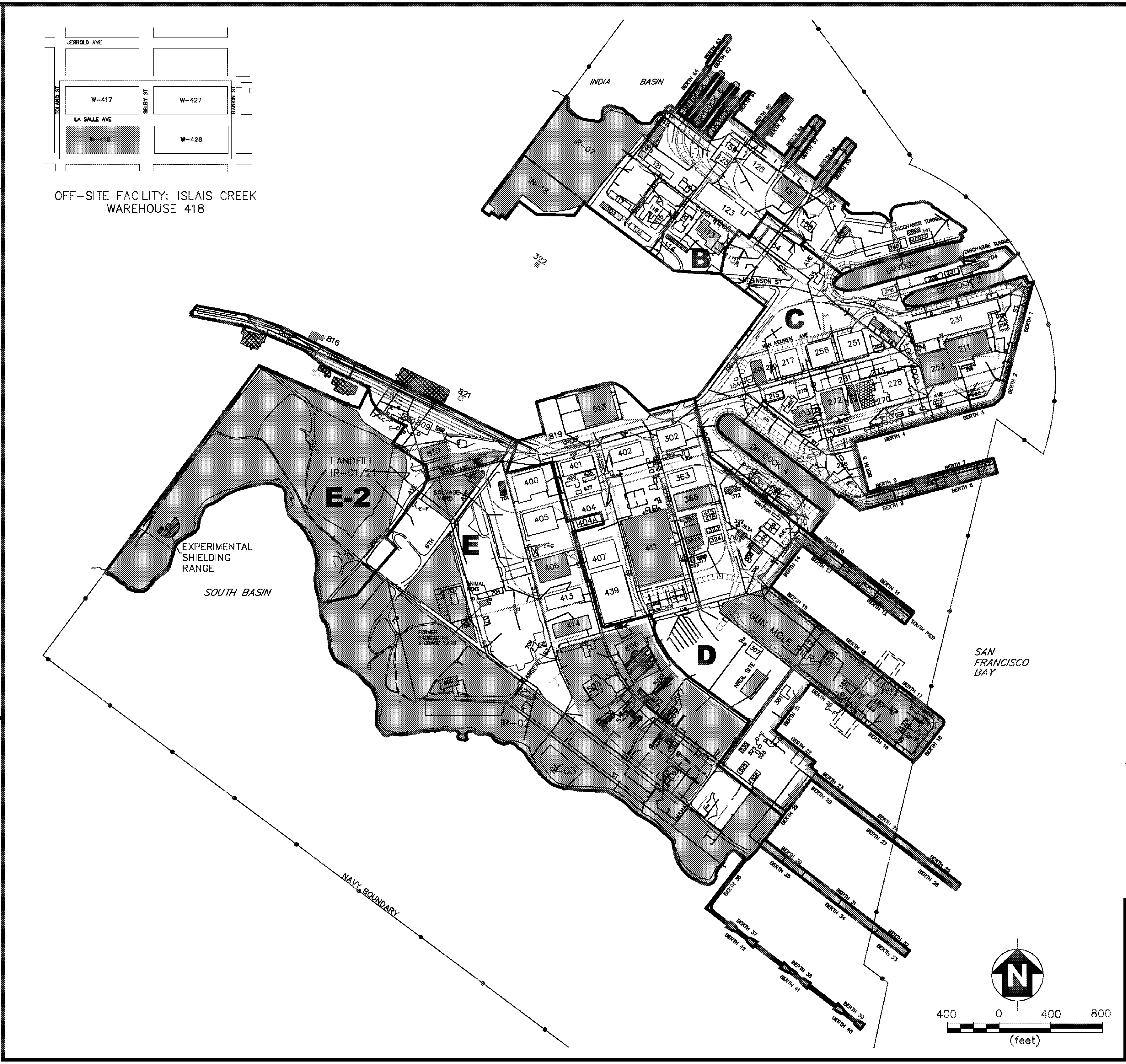
13.0 SWPPP REVIEW AND MODIFICATIONS

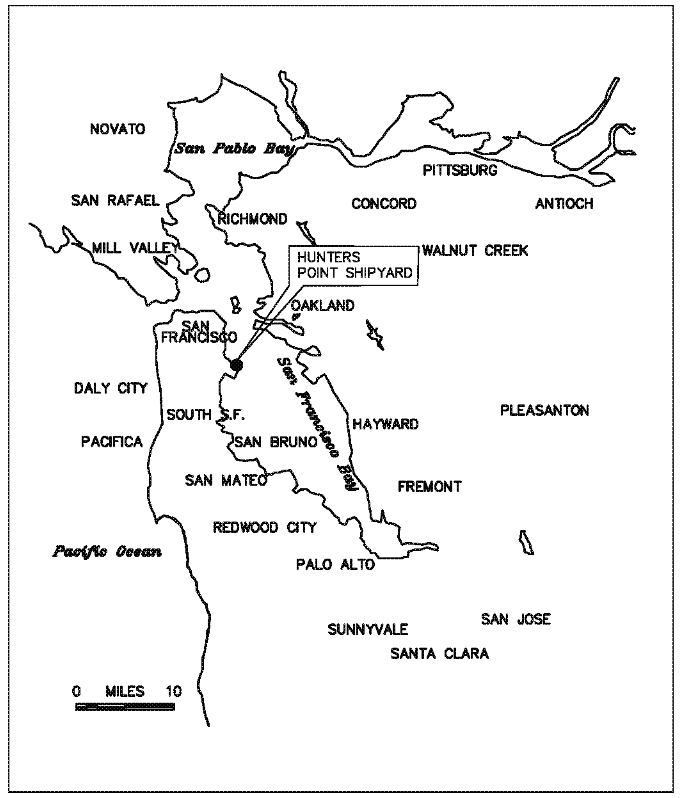
TtEC intends to amend the SWPPP, if deemed necessary, to address changes in the physical condition of the site or to maintain compliance in areas where this SWPPP is inadequate. Changes will be documented in writing and implemented after DON concurrence.

14.0 REFERENCES

The Weather Channel. 2005. Average precipitation amounts at San Francisco, CA (inches). Available online at www.weather.com.

FIGURES





LEGEND

- NAVY PROPERTY BOUNDARY (OFFSHORE)
- PARCEL BOUNDARY
- IMPACTED SANITARY SEWER SYSTEM
- IMPACTED STORM DRAIN SYSTEM
- IMPACTED BUILDINGS OR SITES
- DEMOLISHED IMPACTED BUILDINGS/STRUCTURES
- DEMOLISHED BUILDINGS/STRUCTURES
- IMPACTED SITES THAT HAVE OBTAINED REGULATORY RELEASE
- IMPACTED FUDS SITES
- NON-IMPACTED BUILDINGS WITHIN AN IMPACTED SITE, RADIOLOGICAL PRECAUTIONS MAY BE REQUIRED

NOTE

IMPACTED SITES ARE SITES THAT HAVE KNOWN RADIOLOGICAL CONTAMINATION OR WHERE SITE HISTORY INDICATES THAT RADIOLOGICAL CONTAMINATION MAY BE PRESENT.

FOR PLANNING PURPOSES, ALL STORM DRAINS & SANITARY SEWERS SHOULD BE CONSIDERED IMPACTED.

STORM AND SANITARY SEWER LINE LOCATIONS BASED ON DATA FROM HPS CSO (1995) AND THE FINAL HRA (AUG 2004) THAT HAVE NOT BEEN FIELD CHECKED.

FIGURE C.1-1

BASE-WIDE IMPACTED BUILDINGS, SITES, SANITARY AND STORM DRAIN SEWER SYSTEMS

HUNTERS POINT SHIPYARD-SAN FRANCISCO, CA

TETRA TECH EC, INC.

DRAWING NO: 06067511.DWG

DCN: FWSD-RAC-06-0675 CTO: 0072

APPROVED BY: JS

CHECKED BY: MS REV: 0

DRAWN BY: MD DATE: 04/21/06

P:\1990-RAC\CTO-0072\DWG\060675\06067511.DWG
PLOT/UPDATE: APR 17 2006 15:30:39

ATTACHMENT 1

BEST MANAGEMENT PRACTICES

BMP INSPECTION
HUNTERS POINT SHIPYARD, SAN FRANCISCO, CA

Inspected by:_______________ *Y= YES N = NO* *Date:____________*

ITEMS	IN PLACE	CLEARED	ADEQUATE	NEEDS IMPROVEMENT
Silt fencing or sandbags around downgradient side of excavation				
Storm drains within 50 feet of excavation covered with filter fabric				
Sandbags along base of steeply sloping bank				
Silt fence/sandbags at downgradient toe of stockpile slopes				
Stockpile and debris pile covered with poly sheeting				
Active construction area silt fence, sandbags, haybales				
Bagged/drummed material and drum storage area				
Trackwalk bare soil areas				
Vehicle decontamination pad				
Off-site mud tracking concerns				
General grading to prevent ponding				
Stabilized construction entrance				
Additional BMPs:				

ATTACHMENT 2

SITE INSPECTION AND MONITORING REPORTING FORMS

STORMWATER MANAGEMENT PLAN INSPECTION CHECKLIST

Base-wide Storm Drain and Sanitary Sewer Removal, Hunters Point

Name/Title of Inspector: ____________________

Date of Inspection: ______________ **Time of Inspection:** __:__ **AM/PM**

Type of Inspection: Pre-Precipitation/Post-Precipitation

Weather Conditions: ____

Start of Rainfall (Date/Time): _________________________

End of Rainfall (Date/Time): _________________________

Total Recorded Precipitation: ________________ **inches**

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1. Description of Area Under Maintenance/Construction Contributing to Stormwater Runoff (include location of maintenance area, BMPs in place, type of maintenance activity, condition of stormwater discharge structures):

2. Describe changes to the Stormwater Control Structures, if different than the SWPPP (V-ditches, CMP inlets, swales, etc.)

STORMWATER MANAGEMENT PLAN INSPECTION CHECKLIST
(Continued)

3. Are the Stormwater Control Structures free of debris?

4. Are there areas of erosion?

5. Are there areas of ponding?

6. Are drainage and erosion controls placed around any stockpiled areas?

7. Are the BMPs in place adequate, properly maintained, or implemented?

8. Are additional BMPs required to control stormwater pollution runoff?

9. Recommended corrective actions for SWPPP/stormwater control system:

10. Comments: